THE CONSTRUCTION OF MIND

By

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This study is dedicated
to the memory of
Robert Landis Long

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Although cognitivism is usually traced to convergent inquiries within logic, information theory, cybernetics, and neurology, its intellectual origins are also found in the work of three structuralist thinkers: Lévi-Strauss, Piaget, and Chomsky. In opposition to empiricist and phenomenological theories, each maintained the existence of underlying cognitive structures, laws of thought based on the syntactic manipulation of mental representations that provided a foundation for the computational model of mind. Their efforts to chart the mechanisms of the intellect were accompanied by a complementary axiology that replaced the behaviorist image of a passive, malleable subject with that of an active and autonomous agent.

This dissertation identifies two theories of human nature within the cognitive sciences. Lévi-Strauss and Chomsky endorse the thesis of the structured mind, arguing that the brain is biologically endowed with specialized functions that mature--like physical organs--in the course of "intellectual growth." In contrast, Piaget adopts the model of the constructive mind, explaining cognitive development through general learning mechanisms. The nativist thus presents a scientific version of Kant's critical philosophy, whereas the constructivist, like Hegel, attempts to explain the rational development of reason.

This dissertation criticizes the thesis of the structured mind by demonstrating that its theories are excessively individualistic, biologically unfounded, theoretically underdetermined, and otherwise incapable of explaining the intentional character of experience. Further, although Piaget recognizes the purposive historical dimension in the development of mind, his account remains fundamentally asocial and prone to logicism. However, if Piaget's epistemic subject is interpreted not as a solitary Cartesian scientist producing knowledge through abstract laws of organization, but as a social construct--along the lines suggested by Hegel's philosophy of spirit--then the development of mind becomes an initiation into publically evolving forms of knowledge.

Because a central aim of schooling is the development of mind, this debate clearly raises a number of important educational concerns. This study explores some of these issues by examining the pedagogies these theories support, and concludes by advocating a constructivist philosophy of education based upon the work of Richard Peters.

CHAPTER 1
INTRODUCTION

Philosophy in Education

Francis Bacon once said that the discourses of the philosophers are like the stars above, so high up that they shed little light (Peters, 1972, p. 135). I conjecture that many students of education will find this criticism equally apposite. For although in its present form, the philosophy of education may introduce students to a variety of stimulating issues, it has failed as a subject to address the practical problems facing the teacher. Yet if there is one discipline that is essential to the preparation of teachers, it is surely philosophy, for, in a world that is often defined by change, educationalists can no longer rely upon the set aims, methods, and content prescribed by their predecessors. Tomorrow's teachers must be able to distinguish among the complex of issues that questions of pedagogy generate. While this imperative clearly demands a knowledge of the psychological and sociological research pertinent to the intellectual and emotional development of the child, it also highlights the importance of preparing teachers with the ability to make intelligent decisions in the course of their own experiences.

The ability to synthesize technical information provided by inquiry into a judgment that will support and direct action is a philosophical skill. This realization, in concert with the recognition that teachers will face many difficult social and ethical problems in the context of a multicultural education, ought, one would hope, provide the impetus for a rejuvenation of interest in the role that philosophy should play in educational theory. I shall argue that as a subject in its own right, the Philosophy of Education is pertinent to all educational problems, while as a component of thought, implicit in any inquiry, it is precisely philosophy that saves science from abstractness and, in contrast to Bacon's claim, makes investigation purposeful.

Although it is not my intention to offer a manifesto for the reorganization of teacher education, some general comments are necessary to set the stage for the presentation of my dissertation topic. In particular, since I will be arguing that a lack of philosophical scholarship has obscured the common purpose behind the theories of Piaget, Chomsky, and Lévi-Strauss, it is important to clarify what kinds of questions and inquiries educationalists should be concerned with. By identifying those conditions that have obfuscated the similarity of these views, a program for a more complete comparison should be realized.

The most important observation is that education is not a discipline in its own right. According to Paul Hirst (1974), it has no unique concepts, distinctive methods, or logic of inquiry that it may call its own. Instead, it amalgamates several independent subjects in order to address problems that are of particular cultural significance. In this sense, education is a hybrid interdisciplinary inquiry that Hirst calls "a field of knowledge." From the outset, then, it is essential to recognize the avenues along which thought must travel. Since experience does not come neatly packaged and immediately accessible to analysis, all concerns must be elevated to a level that permits conceptualization. Prior to the employment of any problem solving strategies, there must be a question; and before any question can be posed, there must be a felt sense of perplexity within the situation.[1] Accordingly, inquiry rests on the phrasing of questions in such a manner that problems can be approached through the techniques of the distinctive disciplines. If this process of molding an undifferentiated awareness into the conceptual form necessary for investigation is the first moment of philosophical thought, it should not be the last. For the results of research must be used to requalify our conception of the context that gave rise to the problem. It is this philosophical synthesis, the integration of previously discriminated parts, that should characterize the final stage in any inquiry.

In many instances, however, it seems that the interdisciplinary nature of educational problems actually supports the fragmentation of knowledge and promotes the preoccupation among subject specialists with abstract and increasingly vacuous ideas. By way of an example, consider the range of problems associated with discipline and punishment in schools. Such issues clearly raise a myriad of ethical, sociological, and psychological questions. Philosophers will weigh theories of deterrence and retribution; sociologists must investigate the relationships between teaching styles, authority, and conduct; and psychologists will evaluate the effectiveness of behavior modification techniques. Yet the proliferation of research projects, in each of these areas, will only add to our confusion unless they can be integrated into some philosophical conclusion that crafts a response to our concerns out of these disparate inquiries.

Educational theorists, it seems, have failed to address this imperative, for there exists no forum within which such investigations can be mediated in a true interdisciplinary sense. Students rarely are engaged in the philosophical process of synthesizing the results of research and consequently are ill prepared for the decision making skills demanded by a career in teaching. What forms of punishment are most appropriate within the moral context of education? Should treatment be advocated in place of punishment as a means for controlling behavior? In what respects can children, as immature adults, be held responsible for their actions? Such questions cannot be answered by subject specialists. They exemplify the genuine problems that arise within education and which, because of their context, must be addressed by experts who are prepared to work their theoretical knowledge into a practical solution.

It is the independent attitude of the various disciplines that ultimately give rise to the questions of relevance experienced by students of education. Indeed, as Peters (1974b) complains, not only do the theorists of separate subjects attempt to maintain the abstractness of their inquiries by resisting cooperative projects (in order to support studies that aspire to the rigorous methods of their parent disciplines), they also import their own theoretically generated problems. This can be seen in the highly technical topics of many research projects, where, it seems, far from being sensitive to the needs of the teacher, researchers appear to create problems in order to practice theory.

These criticisms are not meant to question the importance of analysis in educational research. Nor do they suggest that its methods are any less serious than those adopted by more formal areas of inquiry. All psychological, sociological, and philosophical studies conducted by educationalists must employ the technical procedures of their parent discipline. The point here is merely to emphasize the following. First, all abstract thought operates on idealized objects. Consequently, as Dewey (1938) argues, it is only through philosophical analysis that a problem can be phrased into a question suitable for inquiry. Ironically, as Husserl (1909/1965) pointed out, science is not concerned with the empirical particulars and events of the world; its success is achieved precisely because it restricts itself to articulating conceptualizations. Its relevance, and that of all conceptual thought, comes through a philosophical synthesis that interprets the conclusions of inquiry in relation to the practical context of lived experience. Second, to the extent that the reciprocal relationship between philosophy and other modes of thought is ignored, theory will be divorced from practice. This is particularly pertinent in an interdisciplinary context like education, where several areas of inquiry combine to address important practical problems.

From these two considerations the following conclusion can be drawn. If it is philosophy, as the means of framing questions and interpreting answers, that provides the medium for interdisciplinary studies, then philosophy must be recognized as the central component in educational theory. In this respect, at least, if student teachers are to receive any instruction that might be considered relevant to their prospective occupation, it must surely include an initiation into the philosophical component implicit within interdisciplinary thought.

To reiterate, there is a philosophical phase in all inquiry. It starts with the molding of a felt concern into a symbolic representation that permits analysis within the various forms of knowledge, and it is completed with the requalification of experience by the results of these investigations. This, in essence, is John Dewey's (1938, pp. 61-80) logic of inquiry. There is, however, an important presupposition to this method, namely the connection between inquiry and the origin of a genuine problem. This is a relationship that can best be appreciated by examining Dewey's metaphysics of experience.

In contrast to traditional epistemologies that tend to factor the subject and the object out of experience and set one against the other as the seat of knowledge, Dewey recognizes the undifferentiated unity of nature in its constant process of change. "Primary experience," Dewey

(1929/1958) maintains, is noncognitive; "it is of as well as in nature" in the sense that it recognizes "no division between act and material, subject and object, but contains them both in an unanalyzed totality" (p. 4). From this "precarious and perilous" milieu of knower and known, the scientific method must bring order and stability to the world. Yet Dewey believes experience is not without character, for its elements exist in a field of relationships that define a totality or situation.[2] According to Dewey (1938), the pervasive feature of this whole furnishes consciousness with an "aesthetic" appreciation: a quality that regulates the selection of observed facts and directs their subsequent conceptual ordering.

Two important features of inquiry can be observed in this formulation. First, since thought emerges from some felt anxiety, any investigation must take as its point of departure the existing knowledge and scholarship that defines an understanding of an area. It is only through a sensitivity to such latent problems that genuine questions will emerge for investigation. For although it always is possible to construct an artificial task by applying theoretical procedures to experience, inquiry bears the mark of quality when it is demanded by a knowledge of the subject. Second, if the tension within experience promotes thought, it is to this sense of perplexity that intellectual endeavors must return, for the ultimate justification of any research is the unity and coherence that its conclusions will bring to our initial concerns.

Although the Baconian criticism may challenge current educational ideas, it certainly does not apply to John Dewey's philosophy of experience. Indeed, Dewey worked to dissolve any dualism that arose from the artificial separation of thought and experience, and there is no better example of this than his efforts to erase the division between educational theory and practice. Of course, this does not imply that Dewey believed abstract thought was trivial. His point was merely to establish a continuity between common-sense and scientific reason. According to Dewey (1938), there is ultimately no ontological difference between the two. It is simply that certain questions demanded a different emphasis within inquiry. The procedures and subject matter of science--indeed of all abstract thought--are formalizations of common sense problems, and in this respect they are based in experience.

For Dewey, then, specialization does not imply fragmentation. The different disciplines all emerge from, and are demanded by, the practical nexus of thought.

So far I have argued that there is a philosophical component in all inquiry. In an interdisciplinary context, like educational studies, it is particularly important to take this phase of thought seriously, for without philosophical reflection, theory and practice will remain divorced. However, along with its role as the mediator of these domains, philosophy has a second part to play in educational thought. In a more traditional sense, as a discipline in its own right, philosophy has evolved its own distinctive concepts, characteristic concerns, and unique methods of analysis. Whether in epistemology or ethics, metaphysics or the philosophy of science, questions of truth, meaning, and value are approached with the aim of providing conceptual clarification. Since education is concerned primarily with the development of understanding and the acquisition of knowledge, it raises a plethora of issues that must be addressed by philosophical analysis. Indeed, it may be argued that since teaching is a normative activity, philosophical considerations are central to the entire spectrum of educational concerns. Whenever problems of aims, content, or method are raised, philosophical questions are implicitly generated. If this recognition is the first duty of inquiry, then educational theory must, as an interdisciplinary field, make every effort to incorporate a component of philosophical thought in all its investigations.

Despite this demand, the philosophy of education ironically has lapsed into the same state of abstractness and loss of relevance that Peters (1974b) observes in the psychology of education. While it may be interesting to learn what Plato or Dewey thought about education, unless this is integrated within the practical context of a problem solving activity, we simply will be peddling what Whitehead (1929/1957) calls "inert ideas" (p. 1). Philosophy is no different than other disciplines in this respect and cannot be insulated from concrete educational concerns without committing the same bifurcation of theory and practice against which Dewey so passionately campaigns.

The emphasis within colleges of education has been to achieve academic respectability by mimicking the rigor of parent disciplines (Peters, 1973). To this end, educational theory has become self-serving. Researchers have lost sight of its interdisciplinary context focusing their attention on the development of technical skills and the acquisition of specialized knowledge. Although such studies have their place, a more basic task remains neglected. Schools of education should concentrate their efforts on developing informed teachers capable of making intelligent judgments for themselves. Educators must acquire the capacity to understand a situation and phrase a problem; consult and weigh pertinent philosophical, psychological, and sociological knowledge; and then arrive at a solution that is responsive to the context of their concern. This goal can be achieved only if educational theorists practice their trade and engage students in interdisciplinary inquiry. The fragmentation of knowledge and the lack of relevance in educational studies are but different faces of the same fundamental problem. Both stem from the failure to recognize the central role that philosophy should play in educational theory. As a subject pertinent to the clarification and context of educational issues and as the medium for interdisciplinary thought, philosophy must be taken seriously and actively integrated into teacher education programs. For only through philosophical judgement can knowledge direct action. Any theory that fails to recognize this can be no more illuminating than one of Bacon's stars.

If this argument identifies one of the reasons for the contemporary malaise in educational thought, it also suggests a strategy for its recovery: for what I have been attempting to phrase through these considerations is a logic of inquiry, not only to determine why problems of relevance have emerged in educational theory, but also to provide a directive for their resolution. To summarize, thought starts in a felt perplexity that is stimulated by an imbalance within experience and then is conceptualized into symbolic form for abstract analysis. The conclusions of these investigations are then combined through a philosophical synthesis into a judgement that requalifies the initial problem. This method of inquiry will be applied to the topic I propose to study.

Philosophy, Psychology, and the Problem of Mind

A central problem of education is the development of the mind. It is also a fundamental concern of both psychology and philosophy. Typically phrased in terms of concept formation, the growth of understanding, or the acquisition of knowledge, the question of mind has generated innumerable epistemological and psychological problems. Historically, the two great world views of Empiricism and Rationalism have addressed these concerns by proposing models that emphasize either the role of experience or the structure of reason in the course of development. Under each orientation, psychological and philosophical investigations of human learning, intelligence, perception, concept formation, and similar cognitive skills, refine and reinforce its picture of development. Yet within each camp, despite this common end, there appears to be an uncomfortable lack of communication among the researchers of these different fields. It is as if each tradition has adopted a kind of theoretical imperialism over inquiry that maintains a division between questions of logic and psychology. For beyond a general appreciation of their shared assumptions, it seems that the epistemological and psychological theories within each outlook are rarely brought into contact.

Psychologists, who study the empirical aspects of development, have tended to view philosophy as a kind of propaedeutic, a formal phase of thought prior to the employment of scientific methodologies. This attitude has been most noticeable in the Anglo-Saxon world, where the behavioral sciences have equated human subjects to their observable actions. This effort, to provide a law-like account of behavior, independent of human intention, has been introduced into the educational field in works such as Bloom's (1966) Taxonomy of Educational Objectives. There desired educational behaviors like "remembering, reasoning, concept formation, problem-solving, and creative thinking" (p. 15) are defined independently of content. Yet each of these objectives only make sense within the context of a socially shared world of agreed ideas, judgments, and public criteria of truth. We remember something, from certain concepts, and think creatively with respect to given understandings. Only against this background of meanings and standards is human behavior intelligible, and in this respect, at least, psychology presupposes a knowledge of the logical context of social life.

More generally, as suggested in the previous section, all scientific terms are the product of philosophical judgments. Psychology has no context-free ideas and contains no value-independent concepts. The very idea of psychology and the meaning of key terms like "knowledge" and "experience" turn on the initial assumptions of the theory. If psychologists are not clear about these concepts and fail to represent their research in the context of the theoretical orientation under which they are working, there is a danger that their objectives will be confused and their findings misrepresented. Indeed, despite all of Piaget's efforts to the contrary, many popularizations of his work have tended to translate his ideas into a fundamentally different perspective (Chapman, 1988). The intellectual tradition in which Piaget's theory is set rarely is presented as the stage upon which to espouse his psychological findings. Yet, as I shall argue, without an appreciation of this philosophical and historical context, his research loses its purpose, and the initial insights that directed his investigations disappear, leaving a stagnant corpus of empirical facts. Psychologists, then, must recognize that their investigations always presuppose normative assumptions and always generate problems that turn upon the logical analysis of concepts. It is this philosophical component that breathes life into psychological inquiry.

If psychologists have underestimated the importance of philosophical thought, philosophers in turn have snubbed psychological research. In the Anglo-Saxon tradition, where a sharp dichotomy has emerged to partition questions of logic and fact, philosophers have tended to think that "a theory that rests directly upon both empirical and philosophical considerations must have a degree of incoherence" (Hamlyn, 1983, p. 130). Conversely, in continental thought, philosophers have accepted the significance of psychological consideration but, until recently, have remained skeptical about its status as an autonomous discipline. In post-war France, for example, it appeared that the nature of mind lay within the grasp of human reason and that philosophers like Sartre and Merleau-Ponty could determine questions of psychology by fiat. Their powers of intuition seemed more effective and pertinent to a generation of philosophically oriented thinkers than the apparently abstract and unenlightening results of experimental psychology (Piaget, 1965).

Under the spell of such glamorous figures and the pervasive belief throughout French intellectual life in the pre-eminence of philosophy over other areas of knowledge, independent departments of psychology were banished to the academic fringes of the university system. Nowhere was this attitude more evident than in the gerontocracy of professors who controlled the advancement of university faculty through the agregation, an examination system based primarily on philosophical scholarship. As Piaget (1965) summarizes,

> briefly, the implicit permanent principles of the French university authorities are that psychology is a part of philosophy, that every philosopher is fit to teach psychology, but that the converse is not true; that there is no question of an agregation in psychology, since the agreges in philosophy know everything; and that experimental inquiry is carried out where it can be, to the extent to which those interested want to concern themselves with it. (p. 27)

To the extent that philosophers are concerned with the problem of how human beings can have knowledge, they raise psychological questions about the nature of thought and the organs of perception. Empiricists and rationalists alike have developed theories of knowledge that make implicit psychological assumptions about the nature of mind. In fact, the history of epistemology is full of armchair psychologists, the most notorious of whom, David Hume (1740/1981), reduced the exercise of the intellect to habit and custom and based his theory of knowledge on the dictum that "Reason is, and ought only to be, the slave of the passions,and can never pretend to any other office than to serve and obey them" (p. 415). In part, Hume's analysis of reason can be regarded as a response to Descartes, who had trusted the cogito to yield an intuition of indubitable truths about the world without questioning the nature of human thought, a faith in the intellect that Hegel was to criticize as being embedded in conceit. According to Geach (1957), empiricists like Locke and Mill based their explanations of human knowledge on "dubious" accounts of concept formation, whereas Kant (who attempted to salvage the insights of these traditions by constructing an epistemology that reflected the structure and scope of reason within experience) has been attacked by Strawson (1966) for offering a thinly veiled theory of cognition. As I have remarked, even during the first half of the 20th century when the scientific paradigm promoted empirical studies, the psychological investigations of thinkers like Husserl, Bergson, Sartre, and Merleau-Ponty remained characteristically philosophical.

Surely, one would think, if philosophers are to entertain psychological questions, they should do so seriously by basing their arguments on scientific research rather than on conjecture and speculation. Yet, curiously enough, even in the Anglo-Saxon tradition, where the authority of the scientific method has influenced philosophical development, exactly the same attitude of irrelevance is perpetuated between empirical issues and theoretical concerns. For by maintaining a distinction between the context of discovery and the process of justification, psychological facts are held to have no import for logical questions of truth and validity. On either side of the channel, then, whether philosophy suffocates psychology or merely ignores its contributions, a relative estrangement and a mutual animosity have grown between these two disciplines. (For a fuller account of the relationships between philosophy and psychology over the past century, see Harré, 1985, pp. 383-413.)

A Science of the Mind

In Insights and Illusions of Philosophy, Piaget (1965) voices the personal sense of futility and disenchantment that this separation has generated. As we shall see, Piaget campaigned throughout his life against institutions and academic bodies, in fact against any organization of society or knowledge, that asserts truth unscientifically through dogma or intellectual introspection. Philosophy, he maintains, as its name implies, is concerned with values and wisdom, whereas science, which investigates the world, generates questions of truth. Despite these different ends, Piaget claims there is an important and intellectually honest interface between the two. Philosophy must provide the insights that give empirical studies direction and purpose, whereas science can reveal the illusions of those philosophers who claim special knowledge of the world through pure reflection. This cooperative liaison comes to fruition when particular areas of inquiry mature from the informalized intuitions of philosophy and actually develop into sciences in their own right. According to Piaget, history has witnessed this with the natural sciences and disciplines like logic and linguistics. The time is ripe, he argues, for epistemology to make this transformation and evolve into a science of knowledge.

For hundreds of years philosophers have speculated about the central concepts of human understanding--space, time, causality, substance, and so on--without establishing any clear agreement about their role in our comprehension of the world. This in part, Piaget believes, is because such categories are not simple constructs that can be captured within a definition. They have emerged and continue to evolve both historically in the public sphere of scientific knowledge and individually in the child's developing consciousness. Thus, it is only by studying these factual changes and interrelationships that the logical structure of our concepts can be revealed. In short, Piaget believes that philosophical questions about mind can and must be answered by a genetic epistemology based upon psychological investigations into human thought.

Noam Chomsky (1972) proposes a somewhat similar project. In an attempt to rekindle interest in the epistemological questions posed during the 17th century, Chomsky has allied himself with classical rationalists like Descartes and Leibniz, suggesting that the problem of mind now can be solved through a study of natural languages. Quoting Leibniz, Chomsky (1972) argues that "languages are the best mirror of the human mind" (p. 1) and postulates that if a universal grammar can be constructed for all forms of human speech, this would constitute a formal representation of the mental faculty that makes language acquisition possible. Moreover, Chomsky also encourages other workers to extend this model to different aspects of human life, in order to provide similar descriptions of mind, from the analysis of mathematical and musical abilities, to the general morphology of cultural organizations. So like Piaget, Chomsky (1968) does not believe that the question of mind can be solved a priori. In place of the traditional "elitism" of philosophers and the apparent "closed-minded" attitude of psychologists, he advocates a new cooperative science of psycho-linguistics which can approach the epistemological problem of mind empirically.

> In an age that was less self-conscious and less compartmentalized than ours, the nature of language, and the respects in which language mirrors human mental processes or shapes the flow and character of thought--these were topics for study and speculation by scholars and gifted amateurs with a wide variety of interests, points of view and intellectual backgrounds. And in the nineteenth and twentieth centuries, as linguistics, philosophy, and psychology have uneasily tried to go their separate ways, the classical problems of language and mind have inevitably reappeared and have served to link these diverging fields and give direction and significance to their efforts. There have been signs in the past decade that the rather artificial separation of disciplines may be coming to an end. It is no longer a point of honor for each to demonstrate its absolute independence of the others, and new interests have emerged that permit the classical problems to be formulated in novel and occasionally suggestive ways . . . and against the background of developments in comparative and physiological psychology that challenge long-standing convictions and free the scientific imagination from certain shackles that have become so familiar a part of our intellectual environment as to be almost beyond awareness. (p. 1)

The French anthropologist Claude Lévi-Strauss, while not addressing questions of epistemology as explicitly as Piaget or Chomsky, is equally concerned to replace the traditional study of mind with a new form of psychology. After learning philosophy as a young man, Lévi-Strauss (1955), by his own admission, became a skilled dialectition who, like a sophist, could argue an abstract cause without any real concern for its truth or practical import. Tiring of such "empty pleasures," he became dissatisfied with philosophy as an intellectual pursuit, for despite his skills, he found these abstract procedures no more valuable than his "boyish common sense" in solving problems of the world. Like Piaget, he came to regard phenomenology and existentialism as the most "pretentious" examples of this trade, for in placing the ego at the center of the world and linking it to experience through introspection, reality was reduced to the subjective immediacy of thought. And yet, as his earlier readings of Freud and Marx and his interest in geology had taught him, true reality is not immediately perspicuous to sense perception. If the confusion of experience is to be understood in any domain, it must be approached objectively by a science that will reduce the particulars of phenomena to instances of underlying laws. In the case of mind, he thought that philosophical reflection had to be superseded by an anthropological study that would penetrate the idiosyncrasies of behavior and bring the workings of the intellect into focus. It is thus through ethnography, which studies the structure rather than the beliefs and meanings associated with human culture, that Lévi-Strauss (1955) thinks the traditional philosophical problem of mind can be solved.

> And so I stood out against new tendencies in metaphysical thinking which were then beginning to take shape. Phenomenology I found unacceptable, in so far as it postulated a continuity between experience and reality. . . . As for . . . existentialism, it seemed to me to be the exact opposite of true thought, by reason of its indulgent attitude towards the illusions of subjectivity. To promote private preoccupations to the rank of philosophical problems is dangerous, and may end in a kind of shop-girl's philosophy excusable as an element in a teaching procedure, but perilous in the extreme if it teaches the philosopher to turn back on his mission. That mission (he holds only until science is strong enough to take over from philosophy) is to understand being in relation to itself, and not in relation to oneself. (p. 62)

As we will see, all three of these thinkers initiated revolutionary changes within their respective disciplines, reorienting both the aims and methods of inquiry in order to establish a new approach to the problem of mind. As such, a proper appreciation of their theories demands that the arguments they put forward be set against the classical debate between empiricism and rationalism in which the question of mind was first raised. Indeed, Piaget and Chomsky take care to present their ideas within this context, whereas Lévi-Strauss, who developed his arguments in opposition to the claims of phenomenology and existentialism, nonetheless has produced a view of the human mind that is implicitly related to these epistemological positions. All three believe that the problem of mind cannot be solved through philosophical reflection, and they present in their given fields a naturalized theory of knowledge that will address these traditional issues scientifically. The mind, they argue, cannot examine itself objectively; it must be studied through its products, the observable manifestations of human behavior and thought. Yet, by the same token, the contingent elements of experience are also too arbitrary and confused to provide the basis for a scientific theory. So each proceeds to search for a deeper, "truer" reality, an underlying set of regularities that betray the existence of unconscious psychological universals at work in the functioning mind. Just as chemists explain the structure of matter through the composition of elements defined within the periodic table, so these authors attempt to reduce the range of intellectual activity to an underlying grammar of mental structures. Their theories are not of what particular people do or have achieved, but of what human beings, with their distinctive mental and physiological characteristics, are capable of. In short, Piaget, Chomsky, and Lévi-Strauss seek to establish competence models of mind by inferring sets of inner rules that through composition will yield the phenomena observable in the various forms of human expression. Their ultimate--and contestable--claim is that such structures are "psychologically real."

It is worth pausing to consider the scale of these projects. Chomsky has attempted to reduce all languages to a finite set of psychological laws that will generate the syntactic structures of any human grammar; Piaget has proposed mathematical models that reveal the stages of intellectual development; whereas Lévi-Strauss has set his sights on the logic underlying logic cultural organizations, and primitive thought. Each task is an immense feat, and it is hardly surprising that researchers could become involved solely in the technical aspects of linguistics, genetic psychology, or ethnography without keeping in mind the much broader context of these inquiries. But we are in the presence of bold systematizers, contemporary polymaths, who like their predecessors in the 17th century have woven global theories that unite all areas of knowledge into a single conception of mind packaged with a complementary vision of social, moral, and political life. Accordingly, we must take a step back, away from the specifics of research, and examine the fundamental concerns that motivated these projects. When this is done, we shall see that despite differences of detail, Chomsky, Piaget, and Lévi-Strauss are all engaged in the same basic enterprise: to establish psychology as a science of mind.

Although the disciplinary work of these authors ranks them among the most influential thinkers of the 20th century, their common interests and methods of inquiry have also proven pivotal in the emergence of the now dominant philosophy of mind, Cognitivism. I will argue that this new interdisciplinary approach to understanding human nature is a mature version of the structuralist theories developed by Lévi-Strauss, Piaget, and Chomsky. And although Gardner (1987) traces the emergence of this paradigm to developments in logic (Boole, Russell, Turing), cybernetics (Wierner), neurology (McColloch and Pitts), and information theory (Shannon), it was Piaget, Chomsky, and Lévi-Strauss who first demonstrated the necessity of mentalistic explanations in the description of behavior.

Combining empirical studies with epistemological concerns, cognitivism has forged a cooperative union between science and philosophy that promises to reveal the inner organization of mental life and answer the problems of mind originally raised during the 17th century. This prospectus, like the naturalistic epistemologies of these three thinkers, thus offers a perfect illustration of Dewey's logic of inquiry, integrating the different moments of thought into a single purposive enterprise: an interdisciplinary science of the mind. As Howard Gardner (1987) explains,

> I see the invention of cognitive science as a wonderful stimulus for philosophy, on the one hand, and philosophy as an indispensable handmaiden for the empirical scientists, on the other. Philosophy enables us to define fundamental cognitive scientific questions in a coherent way, and assures the proper integration of work in disparate fields. But, by the same token, philosophy must attend assiduously to empirical findings in order to avoid becoming a barren discipline or one irrelevant to scientific work. It is thus fitting that the field of philosophy, whose initial agenda helped to stimulate the rise of cognitive science, has been fueled by that new discipline, even as philosophy can, in turn, help to inform and interpret work spawned by its recent intellectual offspring. (p. 88)

So far I have described the efforts of Lévi-Strauss, Piaget, and Chomsky to found a new interdisciplinary psychology to replace the traditional speculative approach to the problem of mind with a scientific study of human thought. I shall now discuss some of the common themes that unite their respective theories in this enterprise. I will argue that while each of these authors worked within different intellectual traditions and addressed different theoretical concerns, nonetheless they all formed parallel responses to similar sets of problems. To explain these congruences and trace the historical roots of cognitivism, I will briefly present some of the chief developments in the rise of the social sciences during the past century. For it is only when viewed against the emergence of psychology as a discipline and the call for a scientific account of human action that the parallels between these thinkers come into focus.

Cognitivism and the Structuralist Science of Mind

The first and most important observation to be made in comparing Chomsky, Lévi-Strauss, and Piaget is that each can be considered a member of the structuralist movement that reached its intellectual zenith during the 1960s. All three reject the existentialist viewpoint of the introspective Cartesian ego and the search for mind through philosophical reflection. In its place they hypothesize the existence of unconscious cognitive structures that underlie the apparent confusion of human behavior. Through scientific inference, each proposes to model these structures mathematically in order to capture the universality and necessity they believe to be implicit in human thought. As Lévi-Strauss (1976) explains, structuralism mimics the natural sciences in its efforts to identify a system of rules for human action that parallel the laws which account for the behavior of physical objects.

> The physical and natural sciences have achieved this stage by succeeding in isolating for each type of problem a small number of significant variables at the heart of quite complex phenomena. We of the human sciences, or those claiming such status, remain overwhelmed and submerged by the number of variables and all the more so since, for us at the outset, this number is incomparably higher. Besides, science studies objects, and it is particularly difficult for man to agree to become an object for himself by making an abstraction of his subjective existence, since he is at the same time both subject and object. . . . What one calls, correctly or not, structuralism constitutes precisely an attempt, in a few fixed and limited areas, to circumvent this twofold obstacle. Structuralism tends towards objectivity by considering preferably those

> phenomena which develop outside the disturbances and illusions of conscious thought processes, and for which it is possible to restrict oneself to a relatively limited number of variables which may explain the diverse forms that he same phenomena take on in different societies. (p. 44)

Two classes of theories can be identified within the structuralist movement. The first espouses a belief in the fixity of structures and holds that the human mind is innately disposed to construct the world through a finite set of categories. This according to Ricoeur's (1963) characterization of Lévi-Strauss, is "Kantianism without a transcendental subject." I will argue in Chapter 4 that this is also an appropriate description of Chomsky's theory of mind. For despite his Cartesian allegiance, it is clear that Chomsky does not believe in a self-conscious knowledge of language. I will suggest that Chomsky's attempt to link his thesis to the writing of Descartes is based upon a confused interpretation of universal and necessary truths in rationalist thought and that the biological nativism that he in fact proposes actually commits him to the same epistemological position as Lévi-Strauss.

The second set of theories attempts to unite process and structure into a dialectical account of development. This is the basis of Piaget's constructivism, which denies that structures are genetically determined (with the exception of basic instinctual responses) and attempts to frame a logical explanation of cognitive growth in terms of the autoregulatory mechanisms that he maintains are implicit in all action. In fact, Piaget's theoretical ambitions are even grander, for not only does he believe that these laws of organization underlie the development of the individual's thought, he also is committed to their role in the phylogenetic growth knowledge. So, in contrast to the first orientation that studies structures synchronically, this perspective adds a diachronic dimension by considering the historical development of mind.

Each thesis presents a fundamentally different biological and epistemological orientation to the problem of mind. Yet most critics (e.g., Hamlyn, 1978; Rotman, 1977; Toulmin, 1972) try to forge a somewhat contradictory union by describing Piaget's epistemology as a kind of developmental Kantianism. While this may capture the basic sense of Piaget's project, it does tend to confuse his primary objective, which put in its simplest terms is to describe the logical construction of the mind within the course of experience. In contrast, both Chomsky and Lévi-Strauss, like Kant, believe that mental processes are fixed from birth by the innate structures of thought. Thus, even if this picture of a preformed mind is combined with a maturational account of biological unfolding it still falls short of Piaget's constructivist thesis. For Piaget is committed to the view that reason develops rationally, that conceptual thought is not prefigured in the mind but is determined in the process of comprehending experience coherently. As action reveals the limitations inherent within a conceptual system, new constructs are generated which, at the same time, requalify our understanding and extend our control over experience. According to Piaget, it is not that the next stage of thought is either implanted in the individual's consciousness or determined by history, for both may follow alternate nonrational paths; it is rather that if reason is to grasp the world without contradiction, successive cognitive systems must overcome the inconsistencies implicit within previous levels.

For Piaget there is thus a logical necessity underlying the development of mind. It is this "vector" that raises consciousness from the undifferentiated flux of a newborn child's experience, through a series of dialectical sublations, to the stage of objectivity and the attainment of rational scientific thought. So, as several writers have recognized (Broughton, 1981; Kitchener, 1986), Piaget's theory is actually closer to Hegel's philosophy of spirit than it is to the Kantian view of mind. Yet despite the obvious similarities in language and structure, to my knowledge no comprehensive comparison between these two theories has been attempted. Accordingly, I will argue that, despite a number of contextual differences, both Hegel and Piaget share the same basic objective. Each seeks to explain the development of reason through the dialectical logic of experience and the biological necessity of life.

This interpretation is not without its difficulties, not least of which is that, according to Kitchener (1986), Piaget did not read Hegel and so never seriously entertained the possibility of a relationship between their respective viewpoints. In fact, as Chapman (1988) explains, Piaget does make reference to Hegel in his later writings on the concept of the dialectic, but he shows no knowledge of the philosophy of spirit prior to the 1970s. Indeed, Hegel was introduced into France only in the 1930s by Hippolyte, Kojve, and Koyre (Hippolyte, 1974; Poster, 1983) and then with a particularly Marxist leaning that ultimately fused with Sartre's existentialism. In short, the Hegel renaissance in France represented the philosophical antithesis of Piaget's theoretical convictions. However, I shall argue that there is an epistemological continuity between Hegel and Piaget, the historical conduit of which was Piaget's mentor Leon Brunschvicg. Brunschvicg's lectures at the Sorbonne, along with the writings of Meyerson and Lalande, introduced Piaget to the historico-critical school in the philosophy of science. And it is within this distinctively Hegelian approach to the development of concepts that Piaget's epistemological arguments are always set. Further, while Sartre's views may well be founded upon a reading of Hegel, this does not imply that Piaget's theory cannot also bear a similar comparison. There is surely no single thinker whose work has proven so influential and has provided such a vast number of interpretations as Hegel (Soloman, 1983). In fact, to parody a famous quote by Whitehead, the history of contemporary continental philosophy might be thought of as a series of footnotes to Hegel.[3]

It is important to remember that like Lévi-Strauss and Chomsky, Piaget (1965) rejects the phenomenological psychology of Merleau-Ponty and Sartre. His structuralist theory of mind is not concerned with the individual but with the logical structures of the cognitive unconscious idealized in a universal or epistemic subject. Yet I will argue that this is exactly the point where his arguments run into trouble. For in creating a biological epistemology of the epistemic subject, Piaget's theory of knowledge becomes socially impoverished. Like the Kantian theories of Lévi-Strauss and Chomsky, Piaget's theory of mind presents an implausible picture of each child developing according to an internal logic and adaptation. I will argue against the implicit logicism and individualistic tenor of this viewpoint by demonstrating that knowledge like biological evolution must be understood as a socially creative process that cannot be reduced to an underlying system of rules.

Despite their different allegiances to these two opposed views of mind, the structuralist theories of Lévi-Strauss, Piaget, and Chomsky do share a number of common assumptions. Four important similarities stand out. First, while working quite independently of one another, each proposed to replace philosophical speculations about human nature with a new science of the mind. The traditional concerns of epistemology would thus be solved through observation and experiment rather than the a priori employment of reason. Second, these authors each define a new domain for psychology. While

Lévi-Strauss and Chomsky believe that mental phenomena may ultimately be reduced to neurophysiological events, both argue that a study of human action can also be used to infer the structure of the mind. To use current terminology, they favor a "top-down" approach until superior "bottom-up" theories are developed. In contrast, Piaget (1972a) accepts that physical events can be identified with mental states but denies the reductionist enterprise. I will argue in Chapter 5 that Piaget's vision of a circle of sciences anticipates a central criticism of current cognitive theory (Manicas, 1987), that mental phenomena cannot be discharged into physical properties. However, aside from the question of reductionism, all three identify an autonomous--interdisciplinary--field of inquiry for the study of mind that lies somewhere in between physiology and sociology. Third, each of these thinkers developed individualistic theories of mind in response to dominant intellectual movements that denied the significance of mental states in the analysis of human actions. Piaget (1932) and Lévi-Strauss (1967b), for instance, set their psychologies of the subject against the holistic view of a collective mind promoted by Durkheim, whereas, Chomsky (1957) targeted his criticisms on the behaviorist tradition and the anti-mentalist convictions that supported American social science through the first half of this century. A central premise of the structuralist theory of mind is that human behavior can only be explained through an investigation of mental states. Each subject is seen to possess a representational system in which the physical and social world may be modelled within thought. So like Kant, Lévi-Strauss, Piaget, and Chomsky all identify "deep" structures, inner mental schemes, rules, symbols, or images that constitute the basic elements in what Rorty (1979) has called the mind's "mirror of nature."

Although it may seem obvious to the lay person that thought involves the manipulation of ideas, these thinkers propose the more surprising thesis that such transformations have a systematic character that can be described through sets of logical formulas. It is this fourth commitment to what Fodor (1975) has named "the computational theory of mind" that provides the most striking feature of the structuralist approach. For on the assumption that the mind is a computational device, these authors have attempted to bring the same scientific rigor to psychological explanations (through cybernetics, artificial intelligence models, and computer simulations) that mathematics provides in the natural sciences.

Through concepts like the mathematical group--a system of transformations closed under composition--both Piaget and Lévi-Strauss attempt to construct competence models of mental structures. Likewise, Chomsky postulates similar mechanisms by identifying recursive formulas that can yield the infinite range of syntacticly well formed sentences. The structuralist theory of mind thus presents itself as a mathematical interpretation of Kant's categories. In the case of Lévi-Strauss and Chomsky, these unconscious computational structures are determined biologically, whereas for Piaget, like Hegel, their development depends upon the content of experience.

The prestige and influence of these thinkers during the late 1950s and early 1960s is well documented. But this era, the heyday of the structuralist movement, was also the occasion for the birth of cognitivism and an exciting new approach to the study of mind. Based upon the syntactic manipulations of the digital computer, cognitive scientists attempted to explain mental operations as information processing devices, and in so doing employed many of the concepts and terms used by structuralists. Thus, as psychology looks back and attempts to reconstruct its own history, the role of Piaget, Lévi-Strauss, and Chomsky, while less prominent than that of Bruner, Miller, and Simon, must be recognized as equally important. Indeed, I will argue, the cognitivist view of mind is nothing but a mature version of its structuralist forerunner. As Mandler (1984) recalls,

> in Cognitive Psychology the invention of useful theoretical devices, both in the representation and the processing of knowledge, was a hallmark of the renaissance of the 1950s. Dynamic systems were part of psychology's heritage from the French and German psychologies of the early twentieth century, but the models were crude and their influence faded during the behaviorist interlude. In the 1950s we rediscovered and have reestablished intellectual connections with the insights of . . . the Gestaltists, with the French and Genevan schools, and with the pervasive contributions of the psychoanalytic enterprise. Mentalism in a new form, once again became the model approach, and the old traditions of schematic representations and the analysis of consciousness . . . became commonplace. In Anthropology, the late fifties saw the emergence of representational models in an area focal to anthropological thought, the investigation of terminological systems (for example, in the investigation of kinship terminology). The development of transformational grammars in Linguistics and the notion of deep structure similarly can be seen as the discovery of underlying representations and the processes that operate on them. (p. 13)

This characterization of the cognitive revolution is echoed by Gardner (1987), who in his impressive and lucid account, The Mind's New Science, explicitly recognizes Lévi-Strauss, Piaget, and Chomsky as being among the founding fathers of cognitivism.

> Whatever their differences, pioneering cognitivists like Jerome Bruner, Noam Chomsky, Claude Lévi-Strauss, John McCarthy, George Miller, Jean Piaget, and Herbert Simon showed little concern with the human brain or nervous system. Their focus fell almost entirely on the properties of thought, as suggested by systematic introspection, probed in the psychological laboratory, simulated by the computer, or embodied in the symbolic products of a culture. They made--and won--the case for a level of mental representation, the modeling of higher cognitive processes, and the surface compatibility between human and computer symbolic systems. (p. 394)

Problems in the Philosophy of Mind

In the course of this dissertation I will argue that while Lévi-Strauss, Piaget, and Chomsky developed their structuralist theories of mind independently of one another,each was, nonetheless, faced with a number of similar concerns. In later chapters I shall discuss these parallels in some detail. However, my present aim is to orient these subsequent arguments by describing the context within which the work of these authors should be viewed. Accordingly, I will offer a brief synopsis of some of the main developments in the philosophy of mind during the past century. In particular, I shall focus on the emergence of psychology as a science of the mind and point out some of the epistemological issues that accompany any claim to a scientific explanation of human behavior. Although this exposition will inevitably pass over many important details, it will, I hope, present some of the main issues against which the structuralist theory of mind, and its successor--cognitivism--must be judged.

Until the second half of the 19th century, psychology was considered to be a branch of philosophy. The story of its emergence as an autonomous discipline, while fascinating, is an extremely involved and complex tale (Manicas, 1987). For the purpose of this study however, two conflicting themes can be identified within this development that led to the structuralist psychologies of Lévi-Strauss, Piaget, and Chomsky and to the establishment of the computational theory of mind. First, psychologists had to find a role for mental events in the description of behavior. How can the distinctive characteristics of thought--beliefs, wishes, desires, and purposes--be included in an account of human action? Second, an imperative existed to establish psychology as a discipline by emulating the techniques of the physical sciences. That is, psychologists searched for a causal account of behavior that would match the predictive success of natural laws. On one hand, the unquestionable power of common sense or "folk psychology" suggests that reasons must be given for human actions, while on the other hand, the desire to form a unified and systematic theory of experience has motivated the search for a causal explanation of action.

According to Margolis (1985), the history of psychology can be seen as a series of attempts either to reject or reconcile these themes. It has been argued, for example, that reasons may be ignored in the construction of behavioral laws. Conversely, it has been suggested that psychologists cannot hope to describe human behavior unless they focus philosophically on the meaningful context of social life in which actions are set. More recently, with the rise of cognitivism an attempt has been made to combine these two modes of description through the assertion that reasons are the causes of behavior. Yet, as we will see, this attempt to form an intentional psychology has not silenced the debate. The question of understanding human behavior in terms of both reasons and causes is as contentious today as it was when psychology took its first steps down the road to becoming a science.

A further theme also should be acknowledged. Psychologists have found it necessary to consider the methodological question of individualism versus holism. That is, can social phenomena be reduced to facts about the subject, or must a collective agency be invoked in order to explain human behavior? It is within the theoretical space mapped out by these positions that the structuralist psychology of mind must be judged. (This dissertation is, in part, an attempt to demonstrate that Lévi-Strauss and Chomsky have engaged in the misguided project of founding a science of the individual mind.)

The first comprehensive attempt to address these issues in the Anglo-Saxon tradition was John Stuart Mill's (1875) Logic of the Moral Sciences. In contrast to Comte (1875), Mill thought it was possible to provide a scientific description of mental events that was not reducible to either physiology or sociology. Basing his arguments on the Humean concept of causality--the simple succession and conjunction of events--Mill formulated laws of thought to explain the development of mind through the empiricist notion of learning by association. Ultimately, he believed, all human knowledge, from the truths of mathematics to the structural organization of society, can be deduced from the facts of individual psychology.

In Germany Wilhelm Dilthey translated the English phrase "the Moral Sciences" as Geistwissenschaften, but unlike Mill he argued that the cultural world could not be explained through causal laws. Such descriptions belonged to Naturwissenschaften or the physical sciences. Thus, while psychologists may study human physiology scientifically, to the extent that people live in a socially defined world they also should be concerned with the meaning of human experience. This focus on understanding has oriented Continental interest in the social sciences throughout the 20th century.

In France, August Comte also challenged Mill's model of human nature. As we will see in Chapter 3, Comte was committed to holism and the belief that the individual can be understood only when considered within the social environment. Nonetheless, he believed that society--viewed as a functioning organism--could be investigated with the same methods that were employed by the natural sciences. Indeed, he claimed that his greatest achievement was to have discovered an historical law of "social physics," determining the development of "mind" from its initial religious attitude to the level of science. This "positivistic" approach to society, as an autonomous field of inquiry, was continued by Emile Durkheim, who in a celebrated debate with Gabriel Tarde demonstrated that scientific explanations of human action can be constructed independently of any facts about the psychological states of individuals (Kitchener, 1986). Even in the case of suicide--ostensively a clear example of action based upon reason--Durkheim (1912) was able to establish law-like rules without regard to the subject's intentions. Indeed, in his attempt to defend the autonomy of sociological inquiry, Durkheim even went so far as to argue that "whenever a social phenomenon is directly explained by a psychological phenomenon we may be sure the explanation is false." (Quoted in Rosenberg, 1986, p. 123.)

Like their German contemporaries, French intellectuals greeted the 20th century with a powerful vision of a collective social order. It was against the implicit behaviorism of this prevailing attitude that Lévi-Strauss and Piaget developed their different theories of mind. As I will show, both sought to re-establish the role of the individual by identifying mind with unconscious mental structures. However, whereas Lévi-Strauss believed these computational mechanisms were an evolutionary consequence of the brain's development, Piaget attempted to steer a middle path between Durkheim and Tarde by analyzing society in terms of the relations between subjects. In this way the individual constructs his or her mind through the process of social interaction.

If the structuralist models of mind presented by Piaget and Lévi-Strauss can be seen as a rejection of French social philosophy, then behaviorism--Chomsky's target--may trace its roots to the theory of social thought developed in Germany. For under the influence of thinkers like Dilthey, Helmholtz, and Wundt, the first generation of American social scientists attempted to bring the Geistwissenschaften tradition to the United States. Yet, with the possible exception of John Dewey, none of these European-inspired scholars were able to reconcile the social theory of mind with the political individualism of American life. It was left to John Watson to define psychology in terms of behavior and to apply the associationist techniques of British empiricism to the tasks of measurement and classification (Gardner, 1987). Behaviorism thus was born as a "science of human engineering," and in the same breath psychology turned its attention from the nature of mind to the problems of controlling human action.

To understand how such an impoverished and politically disturbing view of human nature could be successfully maintained for over 50, years the two themes I identified earlier must be considered in a little more detail. The first theme, originating in the work of Franz Brentano, was a concern to accommodate the distinctive character of mental experience. The second orientation, which became known as the unity of the sciences program, is due to the efforts of philosopher-scientists like Ernst Mach (Margolis, 1984). I will consider both of these themes.

Following a line of argument similar to Mill's, Husserl attempted to determine the origin of basic arithmetic concepts by examining the psychological features implicit in the experience of counting. In a famous review of this book, Frege severely criticized Husserl's "psychologism" (Soloman, 1988) by arguing that the merely contingent facts of empirical psychology could never justify the universal and necessary truths of logic. Husserl took this criticism to heart and proceeded to reject all forms of naturalism in favor of an introspective analysis of consciousness designed to reveal the "essential" content of experience. This inner realm of meanings, not accessible through psychological observation, lead Husserl to a concept of the ego quite different from that found in empiricist accounts of behavior. Following his teacher Brentano, Husserl argued that consciousness has a certain "aboutness" or "intentionality" toward experience. In fact, as the terms of folk psychology illustrate, there is an irreducible directedness in thought; we desire p, want q, and believe r. Yet Brentano's emphasis on the intentional character of mental acts, while influencing Husserl (and through him Sartre and Merleau-Ponty) was largely ignored by the psychologists of his time. In contrast to the introspective analysis of consciousness conducted by phenomenologists, researchers like Wundt and Helmholtz proposed a scientific examination of mental experience. While this directive proved to be more influential among the researchers of this era, as I will show, it was Brentano's recognition of the purposive, holistic, and non-mechanical character of mind that ultimately set the agenda for 20th century psychology, namely to form a causal theory of human action compatible with the intentional nature of mental events.

Although Wilhelm Wundt often is cited as the founder of experimental psychology, it is clear from his later writings that he considered the analysis of mind to be an essentially social question (Gardner, 1987). Like Durkheim, Wundt believed psychology can investigate only lower mental functions such as sensation and perception; the process and structure of thought remained the provence of Geistwissenschaften. Yet in studying such basic features of consciousness through the introspective experiences of his subjects, Wundt effected a fundamental break from the tradition of physiological psychology. In his famous laboratory at Leipzig, he instructed an honor role of future psychologists in the techniques of scientific measurement and observation. While many of his students, like William James, later rejected the belief that psychology rests upon the subject's conscious reflections, the methodological practices Wundt established dovetailed with the emerging positivistic view of science. Under the influence of Mach, psychology, like physics, became a descriptive account of observable phenomena written in the incorrigible statements of sense perception. The aim of any scientific enterprise, in this unified model, was to identify correlations between physical events and to subsume individual observations under a covering law explanation (without regard to such metaphysical notions as material cause or inner nature). So, just as physicists did not concern themselves with the concept of matter, psychologists learned to eliminate all references to mind and intentionality. As Carnap (1959) argues,

> so called psychological sentences--whether they are concrete sentences about other minds, or about some past condition of one's own mind, or about the present condition of one's own mind, or finally, general sentences--are always translatable into physical language. (p. 197)

Like Durkheim's functional description of society, positivist inspired psychology was committed to an analysis of human action in terms of causes rather than reasons. By adopting this positivist program behaviorists were able to offer a philosophical justification for the elimination of mental events in psychological explanations. Ultimately, under Skinner, it was argued further that even references to physiological states could be replaced by laws of behavior phrased in terms of stimulus-response regimes. If this science of behavior is purchased at the expense of meaning, a second tradition, often identified by a similar name, "philosophical behaviorism," maintained that actions can be interpreted only in terms of reasons. Inspired by Wittgenstein's (1958) Philosophical Investigations and Ryle's (1949) Concept of Mind, a number of British philosophers attacked the belief that human behavior can be described scientifically through causal explanations. A person's actions are motivated by desires, beliefs, and wishes, all of which depend upon a network of cultural practices. This holistic structure, captured in language, bears the irreducible mark of human intentionality. Accordingly, just as Wittgenstein (1958) explains the meaning of a word through its use, so Peters (1958) argues that intelligent action is to be understood as the following of social rules, and this, he demonstrates, cannot be reduced to a series of mechanical causes. Take, for example, the signing of a check, a typical human action:

> The movements involved are grouped together because they are seen by the agent to be efficient and appropriate means to an end. But it would be impossible to stipulate exhaustively what the movements must be. For if this is a case of a human action the agent must be presumed to be intelligent and he will, accordingly, vary his movements in a great variety of ways. He may hold the pen slightly differently, vary the size of his

> writing according to the space available, and so on, depending on the sort of ink, paper, and pen available. But provided that he produces a signature which confirms to rough and ready criteria--e.g., it must not be typed--more or less any movements will do. I suppose he could sign a contract by holding the pen between his toes. A very general range of movements could perhaps be specified but no specific movements of the muscles, limbs, or nervous system, which must occur before it would be conceded that a contract had been signed. This is tantamount to saying that the concept of an action is inseparable from that of intelligence; for part of what we mean by "intelligence" is the ability to vary movements relative to a goal in a way which is appropriate to changes in the situation necessary to define it as a goal and in the conditions relevant to attaining it. So we could never give a sufficient explanation of an action in causal terms because we could never stipulate the movements which would to count as dependent variables. (p. 12)

Causality, according to Peters (1974a) "is the ghost of the machine" (p. 124), which along with Ryle's (1949) phantom of an inner thinking self must be exorcised to make way for a study of behavior through reasons. For these philosophers there could be no private mental states, all talk of mind being a "category mistake" generated by the improper use of language. On this account, a person's character and intelligence were described dispositionally in terms of behavorial responses evoked by the occurrence of particular conditions. In short, human action was to be interpreted philosophically within the social nexus of meanings--the form of life--that defines existence. Like Winch (1958), Peters (1958) thus sets a revolutionary agenda for the social sciences.

> I want to insist that most of our explanations are couched in terms of this model and our predictions of people's behavior presuppose it. We know what the parson will do when he begins to walk towards the pulpit because we know the conventions regulating church services. And we can make such predictions without knowing anything about the causes of people's behavior unless we include under "causes" things like the parson's training and grasp of the rules, which are things of a different order from "causes" in the sense of antecedent movements. Man in society is like a chess-player writ large. Requests for explanation are usually reflections of our ignorance about the particular rule or goal which is relevant to the behavior in question. We usually know the general pattern but are unsure which part of it is relevant. Sometimes, of course, we are in the position of a free-thinker at a Roman Catholic mass. The question "Why did X do that?" is then usually a request for an elucidation of the whole pattern of conventions. In explaining human actions we, like anthropologists, must all, in the first place be structuralists. Indeed I would go so far as to say that anthropology or sociology must be the basic sciences of human action in that they exhibit the systematic framework of norms and goals which are necessary to classify actions as being of a certain sort. They both--like classical economics--presuppose the purposive, rule following model; in this respect they are quite unlike sciences which imply a mechanical model of explanation. (p. 13)

If philosophical behaviorism proved itself an attractive alternative to both dualism and positivism, it also introduced some important problems of its own. I will mention just two. First, although one might accept that all human actions are defined by a matrix of social conventions, it still seems appropriate to ask for the reason behind a particular behavior, and such demands appear to require a causal explanation. Second, psychologists must determine how it is that individuals develop the capacity to follow social rules and generate meaningful behavior. An obvious answer is that through language and other conceptual structures, each person acquires a representational system that replicates the social world in thought. And if this is the case, cannot the mind then be identified with brain processes, thus permitting a causal account of human action through the equation of mental events with neurological states? Here is the point. Philosophical behaviorism had conducted an external analysis of mind in order to avoid postulating inner non-physical processes. Under this new naturalized interpretation of mental events, inner phenomena now could be explained causally both in terms of the relationships existing between mental states and the physical environment.

This kind of reductionism--in its first formulation, "type identity physicalism"--established a strict isomorphism between mental events and brain states. By postulating mental type-physical type equations, it was thought that the characteristic intentionality of human action could be captured and discharged in causal laws describing material states. Yet as Putnam (1967) argues, why should thoughts be associated with particular chemical configurations in the brain? Is it not conceivable that a digital computer or some silicon based life form could develop a concept of p?

Moreover, what justification do we have for assuming that whenever persons think of the color red their brains must always assume exactly the same state. This strict reductionist enterprise was also criticized by Davidson (1970). While accepting that mental states are both "token" identified with the brain and psychological events are causally related (in the Humean sense), Davidson nonetheless maintained that it is logically impossible to construct psycho-physical laws. Without entering into the details of this argument, it is interesting to note that Davidson, like Peters, thinks human action can be interpreted only within the holistic framework of meaning defined by language. For, in contrast to physical events that can be described precisely, mental states are dependent upon an entire system of beliefs. The peculiar conclusion that Davidson draws from these considerations is that while mental events are both associated with physical states and are causally efficacious, they cannot be included in a covering law model of explanation. This position, which Davidson terms "anomalous monism," not only undermines efforts to describe human behavior scientifically, but also threatens the completeness of the natural sciences, since, as causally indeterminate agents within the world, human beings can originate events between objects in a non-predictable way.

In an effort to construct causal explanations in psychology compatible with our common sense intuitions without reference to brain states, Putnam (1975) proposed a functionalist theory of mind. Just as Durkeim had compared society to an organismic whole,so Putnam, invoking the image of the computer, argued that mental phenomena must be defined within an integrated system. On this view the psychologist is not concerned with the machine's hardware--physiological states of the brain, but is concerned with the manner in which the various components of thought must interact with one another. Unashamedly intentional, functionalism accepts Brentano's holistic view of mental states and attempts to characterize the ways in which human beings think, reason, perceive, remember, and employ language. In fact, it aims to construct programs that will duplicate the phenomena of folk psychology. To this end, Putnam (1975) employed the concept of a "Turing machine" (an idealized information processing device) together with specific tables of instructions in order to duplicate mental acts independently of their physical host. Even so, the autonomy of psychological explanations achieved in the functionalist account is not incompatible with token identity physicalism.

According to instrumentalists like Dennett (1978), the intentional characteristics of the "cognitive organism" can be broken down into submolar components and discharged physically through an army of "blind homunculi." That is, while an "intentional stance" may provide the most useful explanation of behavior, this system ultimately can be reduced to an extensional description of brain states through the notion of a complex hierarchial organization.

> One starts, in AI [artificial intelligence], with a specification of a whole person or what I call, more neutrally, an intentional system . . . or some artificial segment of that

> person's abilities (e.g., chess playing, answering questions about baseball) and then breaks that largest intentional system into an organization of sub-systems, each of which could itself be viewed as an intentional system (with its own specialized beliefs and desires) and hence as formally a homunculus. . . . If one can get a team or committee of relatively ignorant, narrow minded, blind homunculi to produce the intelligent behavior of the whole, this is progress. . . . Eventually this . . . lands you with homunculi so stupid (all they have to do is remember whether to say yes or no when asked) that they can be, as one says, "replaced by a machine." One discharges fancy homunculi from one's scheme by organizing armies of such idiots to do the work. (p. 124)

In contrast to Dennett, Fodor (1975) denies that psychological functions can be reduced to non-intentional components for the simple reason that such homunculi are only defined relationally within the molar. A system cannot be constructed through the summation of its parts unless such parts contain a scheme determining their interactions within the whole. According to Fodor, then, molar cognition presupposes a common representational system that unites the various subfunctions of the mind. Put plainly, Fodor is proposing to re-introduce the philosophically problematic notion of a language of thought to link all the modular activities within the cognitive process. This, he argues, is the simple conclusion that must be drawn when the mind is viewed on the model of the computer. For computations to be possible, there must be a basic programming language or representational system that supports the intentional operations of human thought. Moreover, as I will show in Chapter 4, Fodor (1975) also claims, on logical grounds, that this language of thought--"mentalese"--must be innate. The empiricist theory of learning, he maintains, explains concept formation through the process of hypothesis conformation. But if this is so, the set of representations from which new ideas are generated must be "richer" than subsequently defined concepts. According to Fodor, then, the concepts employed in natural language gain their meaning through the composition of innate semantic primes. Cognitivism, for Fodor, is thus the Platonic theory of concepts.

If an intentional science of mind leads to such radical nativism, then surely the whole enterprise of founding a causal explanation of human action must be fundamentally misconceived. For, as Putnam (1975) argues in response to Fodor's argument, "meanings just ain't in the head!" The intentional content of a term cannot be reduced to infrapsychological states but depends upon the whole sociohistorical context in which it is objectively employed. How could a finite set of primitive ideas--somehow selectively acquired by early homo sapiens--ever be sufficient to deduce concepts such as "yuppie," "black hole," or "computational theory of mind?" Clearly, terms such as these find their meaning within the socially rule governed nexus of language, which, like Saussure's langue and Wittgenstein's forms of life, evolve historically (in unpredictable ways) according to the ever changing needs of human beings.

Fodor is committed to such a strong nativist thesis because, in contrast to Piaget, he thinks that it is impossible to acquire more complex conceptual schemes. I shall argue against this belief and in favor of the historical construction of mind through experience. Yet in rejecting Fodor's methodological individualism, I do not mean to return to the holism of Durkeimian functionalism. Like Piaget I believe a third way can be found between these two poles. Popper's (1979) solution to this problem is the thesis of interactionism, the suggestion that while social structures are created by individuals, they achieve an independent "World 3" existence of their own, which in turn influences and directs human behavior. By interpreting Piaget's constructivism as a social theory of development, along the lines suggested by Hegel's philosophy of spirit, a somewhat similar position emerges. Now learning is seen as a process of initiation into the public modes of thought that have evolved historically within a culture. On this view the development of mind is the gradual process by which the individual comes to internalize the social meanings implicit within the use of his or her natural language. While socialization of constructivism demands a more interactive relationship between language and cognition than Piaget suggests, it does address the problem of intentionality in human action. Moreover, by linking the development of the individual's mind to the social context of thought, all the difficulties associated with Fodor's innatest theory of concepts can be avoided.

Any theory of mind must address two questions. First, "what is the origin of our mental structures?" Second, "how do such structures combine to yield human action?" The nativist appeals to biology to answer the first question, usually concluding that mental rules are somehow selectively chosen according to evolutionary theory. I will argue that this commitment is both unconvincing and unnecessary. The origin of mental structures can be explained through the notion of a general intelligence. As for the second problem, I will argue that the intentional character of human action cannot be captured from the standpoint of methodological individualism. For, as Peters argued, life only makes sense when viewed within the publically defined matrix of rules that regulate meaningful behavior. This systematic whole, captured in the intentional structure of language, defies any and all attempts to phrase a scientific account of action and suggests that psychologists must consider both reasons and causes in their attempts to describe human behavior. As Margolis (1984) summarizes,

> language appears to be sui generis; essential to the actual aptitudes of human beings; irreducible to physical processes; inexplicable solely infrapsychologically; real only as embedded in the practices of an historical society; identifiable consensually or only in terms that presuppose consensual practices linking observer and observed; inseparable as far as meaning is concerned from the changing, novel, non-linguistic experience of a people; incapable of being formulated as a closed system of rules; subject always to the need for improvisational interpretation and, therefore, subject also to ineliminable psychological indeterminacies regarding intention and action. (p. 90)

It should be noted, however, that this change of focus toward the social component of thought does not challenge Piaget's ideas about the pre-linguistic action schemes of infants or the role of experience in the development of concepts. It merely recognizes, as Vygotsky (1934/1962) maintained, that the higher mental functions characteristic of the "social line of development" emerge from the biological foundations of human action--both in phylogenesis and ontogensis--through the agency of language. Indeed, if Piaget (1965) is correct, even the most elementary actions of the infant involve the formation of means-end schemes that ultimately lead to the construction of the subject-object relation and a (pre-linguistic) intentional sense of being within the world.

> Even before language begins, the young infant reacts to objects not by a mechanical set of stimulus-response associations but by an integrative assimilation to schemes of action, which impress a direction on his activities and include the satisfaction of a need or an interest. Although at first unrelated to each other as a function of the various as yet uncoordinated possibilities inherent in the body itself, these schemes become coordinated as a result of reciprocal assimilation, and one can speak of the strict intentionality of these coordinations. And of an intentionality that is creative of meanings, i.e., of the kind of realities the phenomenologists describe in terms of "essences" when they rightly see in intentionality the indissociable bond between subject and objects. (p. 131)

If Fodor's Platonic nativism is rejected, the cognitivist can still maintain a commitment to Chomsky's and Lévi-Strauss's Kantian theory of a syntactically prefigured mind. In this view, while mental representations are not necessarily innate, the computational process that manipulates them are. I will argue also against this weaker version of the innatist hypothesis on the grounds that it is impossible to abstract form from content in the description of human behavior. The idea of an internal set of privately defined mental rules blindly manipulating terms independently of their meaning while, true of computers, does not square with the purposive, intentional nature of human behavior. I will develop this argument in Chapter 3 in response to Lévi-Strauss's study of kinship structures and mythical thought, and again in Chapter 4 in order to criticize Chomsky's theory of a grammatically programmed subject.

None of my arguments are meant to deny that human beings have certain innate capacities. All normal children are born with the capacity to speak French, play the piano, and learn mathematics. However, this does not imply, as Chomsky seems to suppose, that we must be equipped with a specific module of rules that are somehow wired into the brain. Put simply, there is no need to suppose the existence of any innate representations to explain the facts of human development. A suitably rich set of functional learning mechanisms is sufficient for this task. Quine (1969) and Putnam (1967), for example, both believe that intellectual development can be explained through general multi-purpose learning strategies. Likewise, Piaget proposes to account for all forms of activity, from the behavior of simple organisms to the level of abstract thought, through the organizational functions of assimilation and accommodation.

In his efforts to undermine this notion of a general intelligence, Chomsky usually cites two classes of argument: the empirical "poverty of the stimulus" question, or how can infinite ends be derived from finite means, and the logical problem of explaining how the subject abstracts the complex hierarchical structure of language from a set of serial associations. But learning is not simply the accumulation of facts. And as Piaget shows, intellectual development consists in the construction of new and increasingly powerful systems of thought. So, for example, the child's ability to speak English is not learned through the memorization of a particular set of words, but through a process of acquiring the socially created logical structure that holds the whole system of meanings together. As Putnam (1980) argues,

> the child is learning and wants to learn, semantic rules, and these cannot be stated without the use of structure independent semantic rules. So of course (given that his intelligence is high enough to learn language), the child "internalizes" structure-dependent rules. (p. 294)

To recapitulate, Lévi-Strauss, Chomsky, and Piaget were instrumental in the rise of the cognitive sciences. Their structuralist theories made and won the case for a computer model of the mind based upon the rule-governed manipulation of mental representations. In its mature form, cognitivism, this thesis typically is associated with nativism (Margolis, 1984). The strong version of this commitment, found in Fodor's language of thought argument, asserts that the mind is semantically prefigured. Chomsky and Lévi-Strauss advance the weaker claim that the mind has an innate syntactic structure. I will reject both of these positions in favor of a constructive theory of intellectual development. However, while I will support Piaget's notion of a general intelligence, I shall reject his methodological individualism. My argument, in its most general form, will be to demonstrate that while intentional psychology may seek to explain behavior in terms of the causal relationships between mental states, the structure and meaning of our thoughts depend upon the social context of life. As Wittgenstein (1958) argued, "an inner process stands in need of outward criteria" (p. 153).

Conclusion

Statement of the Problem

I have approached the statement of my thesis cautiously in order to spell out the context of thought in which it is set. It is now time to show the three broad projects that this work will address.

By identifying the lack of interdisciplinary cooperation in educational studies as a source of division between theory and practice, I have attempted to phrase a logic of inquiry that will guide the course of this dissertation. My topic, the nature and development of the mind, while being a central concern of philosophy since the 17th century, and more recently--with the rise of cognitivism--the focus of psychological inquiry, is also, surely, a fundamental issue facing educational studies. Yet, as I have argued, the fragmentation of inquiry by subject specialists has resulted in a serious lack of scholarship surrounding this question. In particular, the efforts of Chomsky, Lévi-Strauss, and Piaget are often misrepresented in popular expositions of their work which typically present their empirical arguments independently of the theoretical questions that motivated their research. This is particularly acute in the case of Piaget, who despite his central importance within educational studies has been regarded as somewhat of a philosophical maverick. So while Piaget's epistemological claims are paid lip service in the presentation of his scientific inquiries, philosophers like Hamlyn (1978), it seems, are more interested in making sport of his perceived confusion between the conceptual and the empirical than attempting to make sense of the intellectual tradition in which his ideas were formed. Of course, there are reasons for this apathy: the highly technical nature of Piaget's arguments, the alien character of a different school of thought, and the fact that some of Piaget's most important theoretical writings have not been translated into English. Yet the same lack of philosophical scholarship surrounds our presentation of Chomsky's thesis and Lévi-Strauss's ethnographic studies. In short, there is an urgent need to provide the intellectual and epistemological background to support the views of these thinkers if educational theory is to amount to anything more than the mere cataloging of empirical findings.

To the extent that students of education are at all familiar with the work of these authors, it is usually through a knowledge of their empirical research. Little or no attempt has been made to frame these theories in an interdisciplinary context, although each was conceived with that end in mind. Yet without this perspective it is impossible to understand the intent of the author or to form a practical knowledge of the theory that will serve to direct our judgments. Further, while the student may sense that Piaget, Chomsky, and Lévi-Strauss are all engaged in the same fundamental project--establishing competence models of the mind through psychological studies of human behavior, without an appreciation of the historical significance of this problem and the efforts each of these authors has made to address it, they will have no basis upon which to form a critical comparison of these theories. Thus, despite the importance of the problem of mind in educational theory, a serious lack of contextual knowledge obscures the theoretical continuity that exists between the work of these thinkers. It is important that the similarities and differences between these theories of mind should be shaped into some overall statement that will serve as an orientation to the educationally germane research of these authors. This is the first task that this dissertation will address.

In the previous section I traced the emergence of the structuralist theory of mind through the parallel concerns of Lévi-Strauss, Piaget, and Chomsky. I also discussed the development of this theory into the currently ascendent view of mind, cognitivism. This position may be characterized by the belief that psychology is an interdisciplinary study of the mental rules that govern each individual's mind. In order to explain the nature and origin of this system, theorists like Fodor, Chomsky, and Lévi-Strauss advocate philosophical nativism. In its strongest version, this thesis postulates that the brain is equipped with a language of thought (Fodor, 1983). The weak argument focuses on specific components in the cognitive process and claims that a number of syntactic, content-free rules are acquired innately. The second project of this dissertation will be to argue that both statements of the nativist thesis are untenable.

In their place I shall argue that the most plausible account of the development of mind consists in the individual's construction of social concepts. This approach is captured in the Hegelian reading of Piaget and reflects a fundamental commitment to the cultural evolution of the mind. It is not that each subject invents new conceptual schemes through the internal logic of adaptation, as Piaget suggests, but rather that in the course of initiation into the social world of thought the child learns to construct the logical relationships implicit in the use of language. A psychology based upon this realization will then correctly recognize that human beings are historically as well as socially defined creatures.

This dissertation is about the construction of the mind, both as it occurs in society's historical struggle for knowledge and as a central goal of education. If my arguments in favor of the constructive model of mind are accepted, then the process of education becomes the critically important task of initiating children into the socially evolved domains of knowledge that define our world. In contrast, for Chomsky (1988) education is simply a matter of promoting those experiences that "trigger" cognitive growth, as if the intellectual capacities of children can be coaxed to maturity through the careful nurturing of the "green fingered teacher." However, if the development of mind is not seen as the unfolding of some innate potential but rather as the progressive construction of concepts, then the teacher is involved in a radically different enterprise. This, I will argue, is the more positive task of constructing meaning by introducing students to the distinctive concepts and modes of reasoning employed in the various fields of knowledge. The fundamental feature of this approach, in contrast to the growth model, is a concern with the acquisition of mental abilities. That is, students should be initiated into the forms of thought associated with the important areas of social understanding. As Hirst (1974) argues, what we mean by an educated person is one who can think scientifically, reason mathematically, judge moral issues, and employ aesthetic concepts, in short, display a knowledge of the different socially evolved forms of human expression. If such capacities are also combined with the ability to coordinate these various domains of thought, and turn inquiry into judgment, then education is on the path to the development of character.

Teachers, of course, should epitomize such skills. For as subject specialists, it is through their example and direction that students are introduced into these various modes of thought. Moreover, as educators, teachers must possess the interdisciplinary expertise to determine problems that relate to the aims, method, and content of schooling. It is the third claim of this dissertation that the thesis of the socially constructive mind provides such a framework, linking theoretical questions about knowledge and the process of learning to the practical concerns of the teacher.

Review of Literature

Of course, many of these comparisons and arguments have been voiced before. For example, there is a great deal of scholarship on Piaget's and Chomsky's theories of language acquisition, including the text of their 1975 debate at the Abbaye Royaumont (a conference at which Lévi-Strauss also was scheduled to appear, but could not attend). However, in other areas, notably on questions of epistemology and the historical context of these authors' thoughts, remarkably little work has been done. So while Hamlyn (1978) has compared Piaget's and Chomsky's epistemologies, he has not set their arguments within the structuralist orientation. Further, Gardner (1981), who wrote an excellent comparison of Lévi-Strauss and Piaget as structuralists, did not consider their epistemological relationships in any detail.

At a time when these theories are coming under increasing criticism, and the theoretical foundations of the structuralist paradigm are being challenged, the views of these authors--the architects of cognitivism--should be set in historical and intellectual context, an imperative that Gardner (1981) recognizes in the preface to the second edition of his Quest for Mind.

> As a student of the social sciences in the later 1960s, I became convinced that Jean Piaget and Claude Lévi-Strauss were embarked on parallel scientific enterprises and that their work represented the most significant recent innovation in the sciences of man. . . . When the Quest for Mind was written, little was known in the United States about structuralism. In particular, the role of this largely French-inspired movement within the social sciences was unclear. The works of Piaget and Lévi-Strauss were not well understood and had yet to be related to one another. Nor was it clear (at least to me) how great the claims (and implications) of Noam Chomsky's work would be for the social sciences.
>
> While "structuralism" is still by no means a household word in this country. . . . Many of its assumptions and techniques have been taken over by workers throughout the social sciences--sometimes with credit, sometimes in ignorance (or even in scorn) of the contributions of individuals like Piaget and Lévi-Strauss. But even when a structuralist debt is directly acknowledged, I think that the path breaking contributions of Piaget and Lévi-Strauss are often not sufficiently appreciated. Labels come and go, but contributions last. I believe that the works of the original structuralist writers, and, in particular, of Lévi-Strauss and Piaget have proved to be of genuine and lasting importance. If I were writing the book today, I would add Chomsky to this group. . . .My feeling is that while recent social scientists have in impressive ways gone beyond the first generation structuralists, they have not infrequently done so at the cost of ignoring both the compelling phenomena and the broad vision that first attracted me, with so many others, to the works of Piaget and Lévi-Strauss. (p. xi-xii)

Summary

I began this chapter by arguing that the problem of relevance in educational studies is the product of a preoccupation among subject specialists with theoretically generated questions. Rather than encouraging cooperative projects, this abstract attitude has promoted the fragmentation of knowledge and the separation of theory from the practical context of thought. To address genuine problems, educationists must recognize the interdisciplinary nature of their task and develop a methodology that will permit the results of technical analysis to be worked into judgements that can direct action. Accordingly, I presented Dewey's logic of inquiry and identified two distinct roles for philosophy. First, as the medium in which questions are framed for research and its conclusions are interpreted, philosophy constitutes the essential method of interdisciplinary thought. Second, as a subject in its own right, concerned with conceptual clarification and questions of value, philosophy is pertinent to many of the central issues facing educationists. It is only through these two dimensions of philosophical thought that schools of education can capture the purpose and drive necessary to develop teachers capable of integrating theory with practice. It is against this background that I presented the topic of the dissertation.

A fundamental concern of education, philosophy, and psychology is the nature and development of mind. One of the most ambitious approaches to this problem is the structuralist science of mind. Associated with the work of Lévi-Strauss, Chomsky, and Piaget, structuralism proposes an interdisciplinary project, an empirical study of human behavior, culture, and language, in order to infer mathematical models of unconscious mental structures. Taken together, these theories come into focus as a contemporary attempt to answer the question of mind first posed during the 17th century. Rejecting the Cartesian "I," these authors seek to replace philosophical introspection with a scientific study of the universal and necessary features of thought. Their aim is not to explain a particular individual's behavior, but to frame laws of competence in the guise of an ideal or epistemic subject.

The rise of cognitivism and the computational theory of mind can be traced, in part, to the efforts of these authors and the structuralist science of human nature that each initiated. It is upon their foundational efforts to establish a psychology of inner mental processes that current views of mind stand. Yet interestingly enough, cognitivism is beset by many of the same problems that Lévi-Strauss, Chomsky, and Piaget faced in the formulation of their theories. In particular, questions of nativism, intentionality, methodological individualism, and the scientific explanation of thought are as problematic for cognitivists as they were for structuralists. I will argue that the fundamental error common to both theories is their parallel neglect of the sociohistorical context of life. In their efforts to substitute causes for reasons, these thinkers have abstracted human beings from the cultural nexus of meanings that define their existence. I will show that this has important consequences for educational theory.

Because of the traditional autonomy of the disciplines and the mutual animosity that seems to pervade the relationship between questions of philosophy and questions of psychology, the epistemological claims of these thinkers have not been taken seriously (Manicas, 1987). The situation is especially acute in educational studies, where the point and context of their investigations are usually lost in the presentation of their empirical findings. What is needed, I believe, is a philosophical clarification and comparison of their ideas within the intellectual tradition that they write, along with some assessment of their epistemological allegiances. To this end I offer the following thesis: that Lévi-Strauss and Chomsky are Kantian structuralists, whereas Piaget, who combines structure and process into a theory of constructivism, has developed an epistemology that in many respects parallels Hegel's philosophy of spirit. Both theories attempt to explain the origin and structure of mental representations. The Kantian thesis of the structured mind rests on a form of biological nativism and so passes the baton to evolutionary theory to provide an account of the genesis of intellectual capacities. In contrast, Piaget and Hegel believe in the rational construction of mind through the logic implicit in experience. I will argue against the innatist views of Chomsky and Lévi-Strauss on the grounds that the concept of a pre-figured mind cannot capture the intentional character of human action. Children are not born with a set of content-free rules hardwired in the brain, but learn to structure experience in the course of their intellectual development.

However, while I will support the constructivist thesis, I shall reject Piaget's notion of an epistemic subject. The development of rational thought cannot be explained through an internal logic of adaptation. Instead, I will offer a model of a socially evolving mind based upon Hegel's concept of spirit. On this account education will be seen as an initiation into the historically constructed forms of knowledge that define human experience. This thesis, that education is the construction of mind, has important practical implications at all levels of pedagogy. For if my argument is accepted, the teacher's role cannot be one of nurturing the inner unfolding of the child's innate potentialities, but rather consists in the more positive task of initiating children into socially created modes of thought.

Throughout his career, Richard Peters has attempted to establish a philosophy of education based upon these principles. It is chiefly through his efforts and influence that a generation of British educationalists have approached the practical concerns of teaching and schooling from the perspective of a socially constructive mind. The many interdisciplinary studies promoted by this movement demonstrate that in contrast to Bacon's criticisms, philosophical thought does have a purposeful and concrete role to play in directing judgment. It is to this school of educational thought and its implications for teaching that I will turn in my concluding chapter.

In Chapter 2 I will explore the epistemological background in which the question of mind arose and developed, from the Cartesian ego to Hegel's philosophy of spirit. I will identify two opposing models of mind, Kant's structured thesis and Hegel's theory of the constructive mind, and show how each anticipates the work of Lévi-Strauss, Chomsky, and Piaget. In Chapter 3 I will discuss the origins of the French structuralist movement and trace the sociological tradition in which Lévi-Strauss's arguments are set. Within this context I shall then present Lévi-Strauss's theories of kinship, primitive thought, and the analysis of myth. In Chapter 4 I will introduce Chomsky's analysis of grammar as an attack on the descriptivist school of linguistics and the behaviorist inspired social sciences of the 1950s. In both cases, I will argue that Lévi-Strauss and Chomsky have developed Kantian theories of a structured mind that can be rejected for the same essential reason: Human actions cannot be abstracted from the sociohistoric context of life. In Chapter 5 I will turn to Piaget's constructivist thesis. Here I will offer a social interpretation of the epistemic subject and argue that the development of the individual mind is achieved through an initiation into the culturally evolved forms of thought. The implications of these arguments, that education is the construction of the mind, will be explored in Chapter 6.

A final word, since many of the arguments about the nature of mind put forward by Chomsky, Lévi-Strauss, and Piaget are inextricably linked to their practical studies, a certain amount of technical explanation is necessary to understand their positions. While I shall try to make this discussion clear, the reader should appreciate the interdisciplinary nature of these inquiries and recognize that these authors are committed to the analysis of mind through the formulation of abstract mathematical models that progressively match the complex structure of human abilities.

Notes

[1] Dewey (1938) uses word "situation" in the following sense:

> What is designated by the word "situation" is not a single object or even a set of objects and events. For we never experience or form any judgments about objects and events in isolation but only in connection with a contextual whole. This latter is what is called a "situation." (p. 66)

[2] Piaget (1965) explains his disenchantment with his critics for not understanding the theoretical presuppositions of his psychological investigations in Insights and Illusions of Philosophy (1965). The book contains several anecdotes of how his work has been interpreted in the Positivist tradition or even as a behaviorist description of the development of human action.

[3] Whitehead (1929/1978) said, "The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato" (p. 36).

CHAPTER 2
EPISTEMOLOGY FROM DESCARTES TO HEGEL

Introduction

In this chapter I will trace some of the chief developments in the history of epistemology from Descartes to Hegel. My primary aim is to explicate the central argument of this dissertation: that Kant's theory of knowledge and Hegel's philosophy of spirit parallel the structuralist theories presented by Lévi-Strauss, Chomsky, and Piaget. I will discuss two competing models of the mind. The first, which can be associated with Kant, is the thesis of the structured mind. This theory stresses the fixity and limits of thought and suggests an ahistorical image of an autonomous intellect distributed among all human beings. The second is the thesis of the constructive mind that emphasizes the social, evolutionary, and creative power of reason. This Hegelian view seeks to establish knowledge as a cultural achievement that progressively approaches a more adequate understanding of experience.

By comparing Descartes's account of innate ideas with Kant's concept of the understanding, I will prepare for the argument of Chapter 4, that while Chomsky explicitly aligns his theory of grammar with the rationalist thinkers of the 17th century, his arguments--like those of Lévi-Strauss--are actually Kantian in character. Further, I shall show that Hegel's philosophy of spirit anticipates the central tenets of Piaget's genetic epistemology. Both theories offer an explanation of how knowledge "telonomically" approaches the truth as reason develops rationally through a dialectical logic of experience. However, unlike Hegel who establishes a social theory of mind, Piaget maintains a Kantian commitment--along with Lévi-Strauss and Chomsky--to the individual idiolect as the source of reason. In Chapter 5 I will show how this "subjectivity" sits at the heart of many of the criticisms leveled against Piaget's theory. Accordingly I shall offer a socialized reading of Piaget's contructivism based upon

Hegel's philosophy of spirit. This view of a culturally evolving mind will provide the setting for the educational arguments presented in Chapter 6.

Throughout this dissertation I will seek to advocate the constructive mind over the structured mind and thus favor Hegel and Piaget's view of development to the nativism of Chomsky and Lévi-Strauss. To this end, the epistemological arguments developed in this chapter, in favor of the constructive mind, will also be used to orient my criticisms of Lévi-Strauss and Chomsky in subsequent sections. However, before addressing these issues I will briefly sketch some of the main trends in modern epistemology in order to place the work of Kant and Hegel, and the structuralist movement, in historical perspective.

Overview

The history of philosophy is not a series of dry, abstract problems, advanced by reclusive academics in order to stock the dusty shelves of forgotten libraries. Rather, it is an adventure story of the human spirit, in which remarkable thinkers with the courage and vision to suggest new images of human nature have attempted to elevate the social, moral, and political consciousness of their time.

Although usually told as a series of efforts to overcome dogmatism or combat skepticism, the story of the Western intellectual tradition perhaps is better understood as an effort to establish the universal and necessary character of human reason. It is the historical attempt to raise common sense to a philosophical consciousness by establishing the "transcendental subject"--the "self" that every one of us develops as human beings--within a consistent epistemological position. This transcendental subject first takes the stage in Descartes's postulation of the cogito, where the self is introduced as a pure, but isolated, thinking ego. While this view established the centrality of the mind within epistemology, Descartes's method of introspection failed to yield the knowledge of experience that had been demonstrated by the Newtonian scientists of the Enlightenment. Accordingly, empiricist philosophers--retaining the first person standpoint--attempted to locate this objectivity in the external world, only to find through Hume that the universality and necessity they sought in experience was nothing more than the human habit of association. Hume (1748/1975) thus rejected Descartes's original insight by denying that reason can yield any knowledge of the world. All the volumes of metaphysics, he argues, should be cast into the flames for containing "nought but sophistry and illusion" (p. 165). The best reason can do is to reject the pretensions of philosophers and recognize that human actions are based upon habit and instinct.

In France, Hume's onetime friend, Rousseau, turned away from Descartes's rational model of the self and postulated a new notion of an active transcendental subject, which imbibed with an inner moral goodness, projected its character purposefully in the world. In order to answer Hume's skepticism and to demonstrate that knowledge of the world is possible, Kant placed Rousseau's experiential self at the center of his philosophy. Rejecting the traditional notion of a mind set over against an external reality--a separate world to which it must somehow gain access--Kant argued that the objects of experience must conform to the structures of mind. This is the thesis of "transcendental idealism" that Kant (1787/1964) compared to the Copernican revolution in astronomy. Put simply, it is the idea that the human mind imposes its form on the content of sensations and that this cognitive synthesis ultimately is responsible for the universality and necessity we observe in the world. According to Kant, the scientific laws discovered by Newton do not represent intrinsic properties of reality in itself, but are a feature of the classificatory structure of the understanding.

Hegel (1827/1975) credits Kant with introducing this "critical attitude" in philosophy, but scolds him for timidity in limiting knowledge to the phenomenal realm of experience. Believing that Kant's transcendental idealism was too subjective, Hegel argued that it is not individuals who create the world, but the shared consciousness, or collective spirit, that is embodied in the social and linguistic concepts of a culture. Thus, in contrast to Kant, Hegel does not believe that human understanding of the world must be fixed by a static set of concepts, and he describes the historical development of a variety of forms that progressively define experience in more comprehensive ways.

In order to educate spirit to a philosophical self-consciousness of its role in determining these different world views, Hegel (1807/1977), in the Phenomenology of Spirit, demonstrates the inadequacy of all other epistemological perspectives. By overcoming the implicit contradictions within each form through the postulation of more encompassing conceptual schemes, spirit eventually comes to comprehend the world adequately. This is what Hegel means by "knowledge of the absolute"--the recognition that reality has a systematic character that can be captured rationally in our socially constructed conceptual schemes. At this level, in contrast to Kant's subjectivism, spirit--like Aristotle's categories--captures the structure of the world in thought. This "truth" is the common element in the vast diversity of human life as it struggles historically, from epoch to epoch, attempting to express and fulfill itself adequately. Its purpose, which Hegel shows is the need to know the absolute--the world in itself, evolves behind the intentions and understanding of individual men and women with a cunning and reason of its own.

Inspired by Holderlin's vision of a universal life force (Soloman, 1983), Hegel thus elevated the transcendental subject to cosmic proportions and ambiguously linked it to a pantheistic conception of God working immanently through individuals to achieve perfection. This idealism raised common sense to dizzying heights of abstraction, and, as might be expected, philosophers after Hegel sought to bring it down to the ground. Arguing that it was not consciousness that produced the world, but rather the world that produced consciousness, Freuerbach and Marx turned Hegel on "his head" by defining human nature in terms of the biological and socioeconomic conditions of life. While this new turn to naturalism may have satisfied the demands of common sense, it also smuggled in many of the same epistemological problems that Hegel's idealism had risen to address. In particular, the question of the universality and necessity of reason returned to puzzle philosophers. For whether in the guise of Mill's "psychologism" or Dilthey's philosophy of life, efforts to base reason on empirical fact only lead back to Humean skepticism.

In an attempt to make a fresh start and put philosophy back on track to the absolute, Husserl (1901/1960) ushered in the 20th century by returning to Descartes's method of introspection. The phenomenological examination of experience that he proposed was an attempt to determine the necessary structures of consciousness from the subjective character of thought. By suspending the empirical, he believed reason could capture the indubitable essence of any experience, thus discovering the Kantian categories through an intuition of pure meanings.

Phenomenology was introduced into France by Sartre and Merleau-Ponty. More concerned with problems of human conduct than the epistemological issues that motivated Husserl, they expanded the ego into a full blown individual consciousness and, like Descartes, set it over against an independent mechanical world. Rejecting all talk of objectivity and human essences, their anti-naturalistic humanism turns on the absolute freedom of choice that all individuals possess to determine the course of their lives. On this view, history is an account of human development, the story of how men and women raise themselves from a primitive state to create the world by conquering nature.

The reaction to this new self-confidence in the power of the individual consciousness was swift and scathing. Under the banners of, first, structuralism, and then post-structuralism, critics throughout the human sciences set out to undermine the philosophical commitment to the transcendental subject. Continuing the insights of thinkers like Freud, Marx, and Darwin, they sought to replace the introspective analysis of consciousness with a scientific study of human nature. In particular, structuralists like Chomsky and Lévi-Strauss argued that human beings are biologically determined creatures, so the universality and necessity that originally were sought in consciousness ought to be located in the physiochemical structures of the brain. Since neurology as a science was still in its infancy, structuralists attempted to infer these mental organizations from a "top-down" analysis of the behaviors they make possible. Thus, a new scientific epistemology was proposed that could identify the bounds of human reason by discovering the universal traits that underlie the various cultural manifestations of thought. While this task may appear to be complicated both by the sophistication of modern society and the myriad forms of life that have evolved historically, it must be remembered that structuralism did not propose to analyze the meaning of human existence. Rather, its aim is to determine the common form of all cultural expressions. In short, Lévi-Strauss and Chomsky attempted to capture the mind through syntax rather than semantics.

Since for these writers structure determines consciousness, human beings--contra Sartre--cannot self-consciously evolve their own forms, let alone discover them through introspective thought. Yet according to Piaget, it is possible to conceive of the mind constructing its intellectual categories unconsciously. Indeed, Piaget has authored a vast series of scientific investigations designed to chart the path of the constructive mind by identifying the various logical forms that describe the child's developing cognitive capacities. So within the structuralist movement, the debate implicit in the writings of Kant and Hegel, over the structured and constructive models mind, is played out again at the level of the cognitive unconscious in the theories of Chomsky, Lévi-Strauss, and Piaget.

As I suggested earlier, the work of all these thinkers is not limited to theoretical questions about the nature of knowledge, but also is motivated by social and political convictions. In later chapters I shall argue that Lévi-Strauss and Chomsky try to establish the dignity of the individual in broadly the same manner as did enlightenment thinkers like Kant and Hume. Further, like Hegel, Piaget also is concerned to promote a view of life directed by a religious, biological immanence, a life in which science and value can be reconciled in practical principles and where human beings can unite in following the dictates of reason.

I will now turn to Descartes's theory of knowledge. This exposition is intended both as a propaedeutic to the questions to be addressed in Chapter 4 and as a necessary component in appreciating the epistemological arguments of Kant and Hegel.

Descartes

Although Descartes (1641/1911) looked back on his school days at La Fleche with respect for his teachers, he remained deeply disappointed by his education. Even his resolve as a young man to travel and find in "the book of the world" the knowledge he would need for his life brought him nothing but frustration. For, with the exception of mathematics, it appeared that after centuries of effort there was scarcely a single issue upon which the learned did not hold contrary opinions. Yet, unlike his teachers, Descartes was not prepared to accept any claim to truth on the basis of authority, whether it be the received teachings of the church or the classic texts of antiquity. To be worthy of its name, he argues, a science must have principles that can settle disputes. Accordingly he resolved to put knowledge on a secure footing by replacing the dogmatic corpus of beliefs accumulated under the scholastic tradition with a commitment to truth based upon the exercise of reason. His project was not merely to construct a methodology capable of adjudicating between particular rival claims to knowledge, but the philosophically more ambitious endeavor of founding a system of "indubitable" principles which, through careful combination, could yield certain truth. Descartes's desire to break with the past thus was an attempt to overcome the implicit skepticism generated by the profusion of contrary beliefs held and debated by his predecessors. The inept state of knowledge that he described was, he believed, the result of uncritical thought. Rather than trusting the "problematic" testimony of the senses, he decided to reason only with those notions that appear both "clear and distinct" to the attentive mind. Knowledge, he thought, must rest upon those truths that are so simple and universal that no one could be ignorant of them.

At the heart of the scholastic system stands the syllogistic method which, like the science that enshrines it, confers knowledge by authority. The syllogism neither states the reasoning process of the scientist nor proves the truth of its conclusion. It merely unfolds certain structural relationships between propositions that exist independently of their content. In its place Descartes (1628/1911) demands a method of reasoning through which truth can be conceptualized. Impressed by the clarity of mathematical intuition and the certainty that seemed to accompany all its thoughts, he proposes to apply this model of reasoning to all areas of knowledge, a prospectus for certainty based upon a belief in the homogeneity and universality of thought irrespective of the phenomena under inquiry.

> All the sciences united are nothing but the human understanding, which remains one and the same however varied the objects to which it applies itself, and which is no more altered than is the light of the sun by the variety of objects it illuminates. (p. 1)

Mathematics, for Descartes, is the pristine example of the mind achieving certainty through reason. It thus suggests a paradigm of inquiry for all other sciences: Start with truths so simple and self evident that they cannot be doubted, and proceed by accepting only those ideas that can be formed through intuition.

Before this method can be employed, Descartes first had to establish the veracity of immediate truths, for simply because an idea seems obvious in thought does not guarantee its existential import. The metaphysical link between reason and the external world turns on Descartes's analysis of the cogito. Our notion of perfection assures us of the existence of God. Since it is impossible for a perfect being to deceive, we can be sure that the certainty of our intuitions provides a reliable criterion of truth and falsity. This is the "natural light of reason" that God bestows as a signature of his divine nature.

Descartes's (1628/1911) scientific method thus depends upon the concept of intuition. More certain than the syllogism because of its simplicity, it represents the intellect cognizing truth though a "conception which arises so readily and directly in an untroubled and attentive mind, that thence forward there can be no doubt concerning the object of our understanding" (p. 7). This ability, Descartes (1637/1911) claims in the first part of his Discourse, is distributed evenly among all individuals, although he acknowledges that many have not learned to make use of it. Accordingly, he enumerates a set of rules for the direction of reason. For example, in the seemingly obvious dictum that one should "never accept as true anything which I do not know to be true" (p. 92), he instructs us to recognize that we often encounter confused and complex facts that fail to satisfy the criterion of clarity and distinctness. Rather than trying to synthesize these ideas, as he complains the scholastics did, we must resort to analysis and reduce the involved and obscure, step by step, until only simple ideas remain.

Intuition thus is concerned with what Descartes (1644/1911) terms "simple natures," the set of primary or elementary propositions that are analytically irreducible. Having been derived by analysis, these ideas can then be amalgamated through synthesis, and knowledge can be constructed, as it were, from the basic building blocks of truth. Again this is the work of intuition (or what might more appropriately be called inference), complicated ideas being generated by conjoining a series of simple natures. Thus science, for Descartes, is the a priori synthetic deduction of the complex from the simple. As Descartes (1637/1911) explains:

> I have first tried to discover generally the principles of first causes of everything that is or that can be in the world without considering anything that might accomplish this end but God himself who has created the world, or deriving them from any source excepting from certain germs of truth which are naturally existent in our souls. (p. 121)

It might appear that experience has no role to play in Descartes's philosophy of reason and that all knowledge can be derived from the ideas and faculties of thought granted by God. But Descartes (1628/1911) scathingly criticizes those thinkers who would try to interpret the world independently of experience, as if they believe that "truth will spring from their brains, like Pallas from the head of Zeus" (p. 15). Indeed, the importance of experience in Descartes's system must be appreciated if we are to make sense of his own scientific experiments and studies. Descartes believes that while reason can articulate the innate principles deposited in the mind into a variety of hypotheses about the world, it cannot guarantee that a particular scientific explanation will necessarily describe the implicit character of the world. In the Principles (1644/1911), Descartes gives an analogy of two clocks, each with different internal mechanisms, to illustrate that what can appear phenomenally equivalent may be the result of different structures. The only way to decide between alternate deductive explanations is to test through experimentation which account best fits the phenomena in all its conceived manifestations. Descartes's (1637/1911) method leads from the simplest, most general truths to the most complex and concrete, but it is a feature of his scheme that the conclusion may be an instance of a possible rather than the actual world.

> That power of nature is so vast and ample, and the principles so simple and general, that I can hardly go on observing any particular effect without being aware that it may be derived from them in more ways than one, and that my greatest difficulty is to discover in which these ways it depends on it, and to that end I know no other device than to look about forthwith for some kind of experiment, of such a character that the result will not be the same as it will be if we ought to explain it in the other. (p. 121)

Although science depends upon experiment to match possible constructs with actuality, the source of knowledge resides in the mind, not in experience. This is an important point that I will return to in Chapter 4, for as we shall see from his early writings, Chomsky assumes that all children engage in a similar scientific task in their efforts to construct the syntax of their native language--albeit unconsciously--from an innate set of grammatical rules. For Chomsky (1966), it seems there is a little Cartesian scientist in all of us.

To repeat Descartes's argument, it is the set of simple natures, those concepts that are theoretically irreducible, that provide the metaphysical basis for knowledge of the world. These ideas, which Descartes argues are deposited in our minds innately by God, are known only through intuition, the perspicuous conceptualization of truth through reason. However, Descartes does not believe that we have intuitions of particular things. Innate ideas are not simple facts, stored in our minds like words in a book, as some of his contemporary critics, including Locke, seemed to think he implied. Indeed, Descartes (1647/1911) finds such a thought laughable.

> I never wrote or thought that these ideas are actual, or that they are species in some unknown way distinct from the faculty of thinking; in fact, more than anyone else I am opposed to that empty class of scholastic entities, so that I can hardly restrain myself from laughing when I see the amount of evidence which [our opponent] . . . has collected to prove that infants in the womb do not have an actual idea of God, as though he could spectacularly refute me by this means. (p. 448)

Clearly, then, Descartes rejects the notion that innate ideas are dormant facts stored within the mind. Rather, his thesis corresponds to the arguments for virtually innate ideas,that the mind is programmed to conceive things in a certain manner. In this sense, ideas such as God, extension, and even the motion of the planets, can be thought to exist dispositionally in the human mind, insofar as--under the proper direction of reason--we are led unavoidably to construct them in our attempts to conceptualize the world. This is why Descartes (1647/1911) thought that such ideas were both necessary and universal, even though many individuals may not actually realize them.

> I observed . . . that there were in myself certain thoughts that did not proceed from external objects, nor from a determination of my will, but only from the thinking faculty that is in me; and therefore, in order to distinguish these ideas or notions that are the content of these thoughts form other ideas which are adventitious or manufactured, I called them innate. It is the same sense of the word that we say generosity is innate in certain families; or again that in others certain diseases, e.g. gout and the stone, are innate; not that the infants of these families suffer from these diseases in their mother's womb, but because they are born with a certain disposition or liability to contract them. (p. 442)

Whether or not Descartes's defense of virtually innate ideas answers the arguments of his critics, a more serious problem remains with his belief that such notions are clear and distinct before the attentive mind. This conviction runs counter to the common experience that ideas are learned through time and the labor of thought. In short, rationalists after Descartes were forced to recognize the important role that experience must play in the development of knowledge.

Empiricism and Rationalism

Leibniz (1765/1949), like Descartes, believed that a class of ideas is derived from within the mind. "The soul comprises being, substance, unity, identity, cause, perception, reason, and many other notions which the senses cannot give" (p. 111). In fact, Leibniz's list of innate ideas extended to include all necessary truths. Anticipating Chomsky, he even argues that a certain set of innate ideas is applied without the subject being conscious of them. For instance, Liebniz claims that all individuals employ the rules of deductive logic even though the majority of people are not explicitly aware of them. So, unlike Descartes, Leibniz does not believe that all innate ideas are clear to the mind; some ideas require extensive thought and careful judgment before they can be accepted. This was a prudent advance, since some of Descartes's scientific ideas had already proven false. For example, Christian Huygens had demonstrated that the principle of the conservation of momentum (Mason, 1962), one of Descartes's five main scientific premises, did not stand up under experiment. So the criterion of certainty that Descartes had announced--the clarity of thought--itself was brought into doubt. While Leibniz (1765/1981) accepts the ultimate appeal to intuition, he believes that experience had a wider role to play. In deriving the truths of mathematics and logic, for instance, numerous examples are required to stimulate and suggest ideas to reason. This is particularly clear in geometry, where drawings can help us postulate and discover relationships existing in figures.

It is also important to see that Leibniz does not believe that all minds come to share the same set of innate ideas or even that all innate ideas will be discovered by any single mind. The discernment of necessary truths requires the labor of reason and the appropriate use of experience. Such ideas are derived, not as the empiricist contends through the examination of sense perception, but by reflecting on the structure of our own thoughts. Leibniz (1765/1981) brings out the meaning of this position by reference to a marble statue. He argues that the shape of Hercules can be said to exist latently, or implicitly, in a block of stone in the same sense that its veins are pre-disposed to the shaping of this figure, even though it takes the effort of the sculptor to reveal it.

> Thus it is that ideas and truths are for us innate as inclination, dispositions, habits or natural propensities and not as actions, although these potentialities are always accompanied by some actions, often insensible, which correspond to them. (p. 46)

These ideas are clarified in the celebrated debate between Leibniz and the British empiricist, John Locke. Like Descartes, Locke (1689/1976) states his concern as one of "inquiring into the original, certainty, and extent of human knowledge" (p. 63). He too was troubled by the authoritarian claims to knowledge professed by the scholastics and theologians he had met during his university years. The received opinion of his time was that certain ideas were implanted in the mind by God. Because of their divine origin, such notions are above scrutiny, but nonetheless are capable of generating metaphysical knowledge of the world and principles of moral conduct. Locke sought to undermine the credibility of such doctrines, not by attacking any particular theorist, but by demonstrating the limitations of the concept in general. Locke (1689/1976) identifies the theory of "innate principles" as postulating that "there are in understanding certain innate principles; some primary notions, . . . characters as it were stamped upon the mind of man, which the soul receives in its very first being; and brings into the world with it" (p. 67).

Locke attacks the chief assumptions of this position by showing that each is either at variance with experience or is an unwarranted and superficial assumption. The main argument, advanced by the proponents of innate ideas, Locke believes, is that such principles receive the universal assent of all people. Locke's response is twofold. First he points out that, as a matter of fact, no such principles exist. There is not a single moral ideal that is agreed to by all societies, nor any logical truth accepted by all individuals. Children, idiots, savages, and illiterates are all obviously ignorant of such "manifest" truths as "what is, is" or "it is impossible for the same thing to be and not to be." Second, he argues that the existence of universal consent cannot by itself prove the status of innate ideas, for it might be that an alternative explanation rooted in experience may be given, which by the principle of "economy"

(Occam's Razor), would render such claims superfluous. Chomsky, I shall suggest, has rejected similar advice offered to him by contemporary empiricist critics.

Of course, it might be argued that what is meant by the principle of assent is that upon reaching the age of reason a person is capable of apprehending such innate truths. Locke dismisses this interpretation as empirically false, citing many examples of individuals who never entertain abstract principles. If, on the other hand, the innatist theory is supposed to mean that when we come to understand certain terms, such truths become evident to us, then Locke argues that the theory is trivial. For under such a criterion, the mind will seem to be packed with innate propositions, and the theory will become uninteresting. The innatist doctrine can have import only if it identifies a limited set of ideas; to maintain that all knowledge is innate is either to deny the obvious role of experience or to dilute the meaning of the terms to the point of vacuousness.

So, Locke concludes, if by innate propositions we mean those that are known explicitly, the theory is empirically false. If, on the other hand, we take innate to mean implicitly present or a potential for knowing, then the theory lacks content, for then it simply implies that humans have the ability to assent, for example, to mathematical and logical truths, and such a claim is not denied by empiricism. The added stipulation that such ideas must therefore be innate contributes nothing to the description of the act of knowing, other than to affirm the simple truth that the mind has the potential to make such decisions.

Leibniz developed much of his theory of innate ideas after reading Locke's (1690/1976) attack on this doctrine in An Essay Concerning Human Understanding. He interpreted Locke's criticisms as being leveled against Descartes and proceeded in his New Essays (Leibniz, 1765/1981) to refine and restate the Cartesian position. Leibniz believed that Locke unfairly attributes to Descartes a naive conception of the relationship between the mind and experience. Locke, he argued, describes the mind as a simple receptacle filled with ideas in the same way that a closet might be filled with clothes. So when Descartes denies that certain ideas originate in perception, Locke takes him to mean that experience merely stimulates us to recall ideas already present in the mind. This, according to Leibniz, is a misinterpretation of Descartes's argument. Innate ideas, Leibniz maintains, are simply those concepts that the mind constructs in the attempt to explain experience.

As I have pointed out, Leibniz believes that all knowledge originates within experience. In this commitment, at least, he is close to Locke. Where he differs is in the assessment of the mind's contribution to knowledge. Locke admits certain powers of thought, but does not believe they can generate knowledge out of their own nature. Leibniz, on the contrary, argues that the mind itself also is a source of knowledge. Where Locke is mistaken, in Leibniz's view, is in concluding that because experience provides the context of discovery, it also must furnish its justification. This confuses the logical with the psychological foundations of knowledge.

Leibniz claims that his model of the mind presents a more sensitive interpretation of the relationship between reason and experience that can provide the basis for a reconciliation between Locke and Descartes. For Leibniz--as for Descartes--the world is organized rationally according to the same principles that God placed implicitly in the mind. By reason, therefore, individuals can explore beyond sense experience and know the ultimate reality of things. In response, Locke maintains his criticisms of implicitly innate ideas as being superfluous to an account of human reason and refuses to be drawn into any theory that claims to go beyond the evidence of our perceptions.

An epistemology was required that could do justice to both viewpoints, that would explain the contribution of the mind in the act of knowing, without opening the door to some transcendent reality. This synthesis was achieved in Kant's theory of knowledge. By transforming the rationalist's conception of innate ideas into a priori categories--which give form rather than content to concepts--Kant recognizes the contribution of the mind while limiting its application to what can be known through experience. Kant, therefore, undermines the original purpose of rationalist thought by denying that reason can achieve metaphysical knowledge of the real world. At the same time he rejects the independence of experience from our understanding and turns the tables on the empiricists by showing that knowledge of the world is determined by thought and not, as they would have it thought, by experience. To appreciate the significance of this claim, we need to trace the development of Kant's theory as an attempt to reconcile the truths of these twin epistemological movements.

Kant

Although the rationalist theory of a mind programmed to construe reality in an innately determined fashion seems to anticipate Kant's notion of the categories, there are at least three major differences between these positions. First, unlike Kant's theory, the rationalist account of knowledge is not limited to phenomena but applies to the noumenal world by virtue of the ontological status of the set of innate ideas. Second, Kant's categories only determine the form of experience, whereas Descartes's and Leibniz's ideas include particular facts about the world. Third, in contrast to Kant, Leibniz and Descartes also believe that truth can be determined through intuition. In Chapter 4 I will show that on each of these counts Chomsky's thesis of an innate knowledge of grammar is closer to Kant's theory than it is to the rationalist position.

As I have argued, both Leibniz and Descartes were convinced that God had structured the mind so that through the judicious use of reason the true nature of the world could be revealed. Knowledge of reality can be achieved only when reason transcends appearance and discovers the rational principles that determine the essential nature of things. Although this puts the subject in touch with the world of God, it also strips away the common sense reality of everyday perceptions and threatens the empirical basis of science.

The empiricist tradition, which finds its most coherent expression in the writings of Hume, yields the same conclusion on the basis of the opposing philosophical outlook. Hume (1740/1981) argues that all ideas are acquired through a synthesis of sense impressions. Since reason operates on ideas, it too is limited in its application by experience; on its own, the mind cannot produce knowledge. Thus, when I appeal to my memory, construct scientific hypotheses, or even consult the reports of others, the ideas I form depend for their authority on the experiences from which they arise. Ultimately, I have only my own awareness to fall back upon. But as Berkeley (1710/1978) demonstrates, the assumptions of Locke's empiricism ultimately lead to the rejection of matter--the very basis of Newtonian science--as nothing but an unnecessary and unverifiable postulate inferred from the continuity of our ideas. Experience, Berkeley argues, is simply the sum of our ideas; objects exist only in so far as we perceive them. Hume (1740/1981) even pursues the implications of this argument to cast doubt on the thinking ego, Descartes's Cogito, believing that wherever he searches for the self he finds nothing but perceptions. The idea of a mind, he concludes, is only a product of our imagination. For Hume, Descartes's faith in reason is turned into a radical doubt that even undercuts the identity of our thoughts.

Clearly, a skeptical attitude that attacks the source that supports it cannot be consistent. Indeed, the necessity to silence any form of doubt that undermines the objective reality of everyday objects is paramount if a foundation is to be laid for the pursuit of science. This, in part, is the task Kant sets for himself in the Critique of Pure Reason (1787/1964), to establish the objectivity of commonsense perceptions in a manner that accords with the scientific laws established by Newtonian mechanics. Empiricism dismisses metaphysics, but if an objective knowledge of experience is sought, some link must be established between knower and known. The problem is thus to provide the ontological basis for science without accepting the Leibnizian world of speculation.

Kant's objective is to retain the truths of both theories without falling into the subjectivism of Hume or the absolutism of rationalism. His solution rests on what he announces as his "Copernican Revolution" in philosophy. Previous thinkers had concentrated their efforts on explaining how human beings equipped with distinctive perceptual organs and cognitive faculties could gain knowledge of the external world. Yet for Kant, this enterprise leads to endless contradictions and frustrations that undermined the reality of commonsense experience and the pursuit of science. So in contrast, Kant phrases the problem as one of determining what we can know a priori about the objects of experience given that they must conform to our knowledge of them. By this, Kant does not mean to start an investigation into the nature of the object itself, since this lies beyond our perceptions, but rather wants to investigate the object considered as an element of experience. For unlike the empiricists who postulate a passive mind, Kant, following Rousseau, sees experience as the product of an active faculty that shapes sensations in the process of cognizing them. This is not to endorse Berkley's absolute idealism, but merely to recognize that the structured mind imposes its own form on our sense impressions. So for Kant, experience is not the simple homogenous medium Hume perceived it to be, since it already contains an intellectual structure. That is, in contrast to empiricists, Kant argues that all sense perceptions are a synthesis of the environmental stimuli and the rules of our understanding.

The radical skepticism of Hume convinced Kant that experience alone cannot yield either the necessity or universality of knowledge. But for knowledge to be possible, an element of objectivity is essential. In science, for example, all empirical laws depend upon the concept of causality. (Even the possibility of perceiving an object rests upon the condition that sensations exist in some relation to one another. Accordingly, when we observe something, we do not just see a bundle of impressions, but a coherent structure.) Since as Hume demonstrates, such propositions or judgments cannot come through experience, Kant concludes that they must exist in the mind a priori. That is, while experience is necessary, it cannot be a sufficient condition for knowledge. It is rather the structures of thought, extending to all possible sensations, that determine the character of our experiences. As Kant explains (1787/1964, p. 55), the Critique of Pure Reason may thus be regarded as an attempt to justify the possibility of such a priori synthetic judgments.

Kant believes that three distinct classes of a priori synthetic judgments can be identified: (a) mathematical propositions, such as "7 + 5 = 12" and "the shortest distance between two points is a straight line"; (b) principles of natural science, such as the law of causation; and (c) all the propositions of metaphysics. He seeks to prove the possibility of mathematical judgments in a section of the Critique of Pure Reason called the "Transcendental Aesthetic." In the "Transcendental Analytic" he asks how a priori judgments of physics are made, and, finally, in the "Transcendental Dialectic" he discusses their role in metaphysics.

If the existence of a priori synthetic knowledge of experience can be seen as an answer to Hume's skepticism, Kant also seeks to prevent the extrapolation of such truths into the extravagant metaphysical systems of his rationalist predecessors. His solution is to limit the faculty of understanding--verstand--to those ideas that can be expressed as possible sense experiences. This is the meaning of transcendental in Kant's philosophy. Any metaphysics that uses concepts to transcend experience and describe the supersensible world beyond our perceptions, as Leibniz had done with the category of substance, cannot possibly claim the title of knowledge. Such "flights of fancy" had made metaphysics "the arena of endless disputes" and had not brought humanity one step closer to the most important questions of life: freedom, the human soul, and the nature of God (Korner, 1977). This is not to say that it is inappropriate for reason--vernuft--to pursue such ideals; it is simply to demarcate the proper limits of metaphysics. Indeed, a major section of the Critique of Pure Reason, the "Transcendental Dialectic," is concerned with uncovering the illusions that previous metaphysicians have created by transgressing the bounds of possible experience.

Kant's aim is therefore to replace traditional or "transcendent" metaphysics by a new discipline that matches the status of other areas of a priori synthetic knowledge (e.g., mathematics and physics) and gains the universal and permanent status as a rational science. Kant's Copernican revolution thus sets the stage for a transcendental metaphysics; an investigation of the fundamental concepts through which we construe reality, in order to chart the limits of sense prior to the employment of reason. In short, before engaging in speculation about the nature of the world or the existence of God, Kant thinks a critique of reason is required to determine how far and in what respects the human mind can comprehend such infinite matters. Reason may be led by its own inner logic to pose such metaphysical questions, but it is important to determine in advance how it may employ its concepts legitimately.

Prior to Kant, philosophers assumed that all knowledge must conform to the object, a belief that ultimately frustrated any attempt to understand the world a priori. By asking "What must the world be like if objects are to conform to our concepts of them?," Kant turns epistemology from the investigation of regularities perceived in the external world, to the structure imposed upon experience by the human mind. Under this orientation, the laws of nature are revealed as the systemizing and categorizing functions of the understanding which order the raw data of our sense perceptions.

According to this thesis, experience is a network of relations constructed by the application of concepts to sensations. Since all perceptions must fit into this closed internal order regulated by the properties of the mind, Kant offers a quasi mathematical view of thought as a group-like holistic system. Once this view of the understanding is accepted, transcendental metaphysics can investigate a priori the nature of human cognition by determining the necessary elements implicit in any act of judgment. At the same time, the universality of these structures provides synthetic knowledge about the character of all possible experiences.

For Kant (1787/1964) therefore, knowledge has a dual origin in sensibility, on the one hand, and the understanding on the other, and it is only in their conjunction that objective judgments can be made. Previous theories had tended to emphasize one of these elements at the expense of the other. "Leibniz intellectualized appearances, just as Locke . . . sensualized the concepts of the understanding" (p. 283). The mistake was to believe that reason or experience alone can provide knowledge of the world. As Kant (1787/1964) puts it, "thoughts without content are empty, intuitions without concepts are blind" (p. 66). This is a criticism that is echoed in Piaget's account of the genesis and structure of knowledge.

To repeat, Kant's (1787/1964) basic assumption is that judging and perceiving are fundamentally different activities corresponding to separate faculties of the mind. "By means of sense objects are given to us and sense alone provides us with perceptions; by means of the understanding objects are thought and from it there arise concepts" (p. 65). Since all thoughts, either directly or indirectly, must refer to perceptions, one area in which Kant can investigate the necessary structure of experience lies in the a priori elements of perception. In the "Aesthetic," these forms are identified with the intuitions of space and time, which according to Kant provide the medium for all perceptions and thus the basis for the a priori synthetic judgments of mathematics. For example, by considering the structure rather than the content of our sensations Kant attempts to determine a priori the nature of all possible spatial experiences and thus derive the laws of geometry. Space and time, according to Kant, are transcendentally ideal and empirically real. By this he means that our intuitions of space and time arise from the structured mind rather than from empirical objects and that any perception we can have of the world must be spatiotemporal. This is an important point. Kant does not believe that the noumenal world, the realm of objects in-themselves, is known through these intuitions, but only the phenomenal reality of the ideas we experience in thought.

When the understanding applies concepts to perceptions, two types of judgments may be formed, either a posteriori abstractions or the a priori ordering of the objects of sense. Both are synthetic, but while the first describes appearance, the second set of concepts transforms sensations into a unity. The concept of causality, for example (which as Hume observed is not contained in any sense impression and yet is at the heart of all the judgments about the natural world) unites perceptions into a matrix of order. Given this synthesizing function of the understanding, Kant thought that he had fallen upon a clue to the enumeration of all such pure concepts or "categories." Since to make a judgment is an activity in which the understanding employs concepts, the logical structure of all possible judgments must be determined by the set of categories. So because Kant believes that there are four logically different forms of judgement, each with three different modes of expression, he identifies twelve categories to which they corresponded.

While Kant employs this argument to establish the existence of the categories, he still faces the task, in the "Transcendental Deduction," of proving their status as necessary conditions for knowledge. This is a complex argument, in which Kant moves from the permanence of the "I" in thought--the unity of consciousness--to the possibility of making objective judgments,and thus to the necessity of the table of categories for knowledge. Without going into the details of Kant's demonstration of the essential role these concepts must play in thought, two facets of his argument are important for this discussion. First, Kant provides a refutation of Hume's skepticism without accepting the power of the Cartesian ego. As I described earlier, Hume concluded that the concept of the self is a product of the imagination. What Kant's (1787/1964) argument shows is that the unity of our thoughts presupposes a synthesizing consciousness. As he explains, "it must be possible for the 'I think' to accompany all my representations" (p. 152). That is, because sensations are always experienced as a coherent organized whole, we can be sure that a thinking ego applies the categories to all our perceptions. However, the second point is that Kant--unlike Descartes--did not believe we could have immediate knowledge of this self. The transcendental subject, the "I" that is necessary for all thought, can be experienced only as an empirical ego. Like any other element in the noumenal world, it lies beyond thought and may only be witnessed through its phenomenal appearance. Kant thus rejects any speculative or "rational psychology" (e.g., Descartes's examination of the cogito) that attempts to characterize this self as a substantial enduring subject. Such conceptions of the self apply the categories beyond their domain, to that which is the condition for, rather than an object of, experience. It is also to incorporate the "I" of thought into the empirical and causally ordered world of space and time, which as Kant (1790/1951) shows in his second Critique goes against the fundamental sense of freedom we are all capable of experiencing.

It is this concept of a transcendental subject lying beyond rational investigation that marks the difference in the views of mind presented by Kant and contemporary advocates of the structured mind thesis like Lévi-Strauss and Chomsky. For as we will see, while they accept Kant's notion of an ordered intellect, both reject the idea of a noumenal realm in favor of a materialistic naturalism that explains the laws of thought through the physiological mechanisms of the brain. In effect, the structuralist theories of Lévi-Strauss and Chomsky are Kantian without a transcendental subject.

If the Transcendental Deduction can be seen as an answer to Hume's skepticism about the self, the section of the Critique called the "Refutation of Idealism" turns the same argument on Berkeley's "dogmatic" dismissal of the external world and Descartes's "problematic" conception of reality (as revealed in the method of systematic doubt). Putting aside whether or not Kant's representation of these positions are faithful to their authors intentions (Korner, 1977, p. 92), his argument seems to be that just as a transcendental subject is necessary for all judgments, so a transcendental object, the thing-in-itself, is required for any experience. The point of Kant's philosophy is not to question the reality of the external world--Kant was a realist in this sense--but to establish the limits of human knowledge. He recognizes that just as we can infer the existence of a thinking subject, so we can be sure of the world beyond our perceptions. There must be something "causing" our sensations just as there has to be a self that is conscious of them. However, because thought is restricted to phenomena and experience is structured by the application of the categories, Kant admits that he could not speak of either the subject or the object, but merely the necessary features with which they must appear to us.

While the arguments in these two sections attempt to reverse those of Descartes (in that the cogito is justified from the necessity implicit in experience, rather than "unpacking" the world out of the intuition "I think"), Kant's line of thought remains broadly Cartesian, consisting in an examination of consciousness with the aim of developing an internal, subjective criterion for truth and objectivity. Like Descartes, he starts with the undoubtable fact of conscious experience and shows that the basic propositions of metaphysics are simply descriptions of our thoughts, that is, the rules according to which we construe the world. This being so, the understanding is properly seen as the "lawgiver of nature," following the rules of operation set out by the concepts presented in the table of categories. Moreover, these laws, Kant demonstrates, are rational, sufficient, and universally valid for any experience.

By studying the categories--a task he termed "transcendental logic"--Kant thought it possible to determine their necessary application to all sensations and thus gain a priori, knowledge of the nature of any object that can be entertained in thought. But our cognitive functions are not limited to the application of general concepts to particular perceptions. A second set of a priori concepts also exists that, while similar to the categories in that they are not derived from experience, differ because they cannot yield any knowledge of the world. Kant (1787/1964, p. 310) calls these the class of "Ideas," possibly because they are intended to remind us of the nonsensuous "Platonic Ideas." These are the concepts furthest removed from experience, and for this reason, they are the most likely to lead us into error. Yet they also are the most significant, for Kant believes that it is only through these ideas that the classic metaphysical questions of God, freedom, cosmology, and the human soul can be addressed. Reason, he claims, is the faculty that employs these ideas, and he identifies it as having two distinct tasks. First there is theoretical or speculative reason that attempts to employ ideas in empirical thought but which, because of their remoteness from experience, runs the risk of leading us into logical absurdities. For while the understanding cannot harbor contradictions, dealing as it does with matters of fact, reason is free to operate abstractly with its own concepts and--as the history of philosophy shows--is quite capable of entertaining equally plausible but contradictory arguments. The second and more fruitful role for such concepts lies in the sphere of practical reason and questions of moral conduct. In this field the abstractness of such concepts from sense perception is less important, for the moral domain is concerned with human actions and the sense of free agency that derives from the experience of the noumenal self. The role of reason in this sphere is to determine what ought to be, rather than what is the case.

In the Transcendental Dialectic, Kant focuses on humanity's historically hopeless attempt to comprehend such infinite questions. Since reason, like the understanding, is also a faculty of judgment, Kant (1787/1964) believes he can identify the set of ideas by considering all the possible forms of logical inference. He examines three different kinds of syllogism: first, the categorical, which yields the ideas of an absolute subject (the soul); second, the hypothetical, which suggests an absolute unity of conditions in experience (the world); and third, the disjunctive inference, which produces the absolute unity of the entire range of thought and the concept of a perfect being (God).

> All transcendental ideas can therefore be arranged in three classes, the first containing the absolute (unconditioned) unity of the thinking subject, the second the absolute unity of the series of conditions of appearance, the third the absolute unity of the condition of all objects of thought in general. (p. 323)

The function of these transcendental ideas (which relate to the subject, the object, and their unity) is to lead the understanding with its conditional concepts toward the unconditioned (the "absolute" or "infinite"). But this regulative task at times is confused by reason's natural propensity to assume the objective reality of such ideas. For Kant, human comprehension is founded upon and limited to the phenomenal world of appearances given in sense intuition. Accordingly, the illicit move manifested in each of these judgments (corresponding to the three logical forms of inference) is the attempt to know the world intellectually. Such knowledge can only belong to God, and all human efforts to match it ultimately lead to contradiction.

Kant explores these fallacies of reason in the "Paralogisms" (which deal with ideas concerning the soul), the "Antinomies" (which question our judgments about the world), and the "ideals" (which concern arguments for the existence of God). I have already discussed Kant's arguments against rational psychology, and I will return to them again in Chapter 4. The antinomies are particularly interesting because they show how the dialectic--the process of reasoning that Kant called the "logic of illusion"--leads to contradictions. For Kant, such paradoxes in our reasoning about the world indicate that thought had transgressed the bounds of what human beings can know. Yet for Hegel, such contradictions mark only a moment in the philosophical endeavor of knowing the world. Kant had re-introduced the dialectic into epistemology to show the limits of the structured mind. Hegel, in contrast, molds it into the principle of constructive reason and employs it to put the mind in touch with reality.

In the Ideals, Kant rejects the traditional "proofs" of God and claims that we can have no theoretical knowledge of a supreme being. It is rather in the sphere of practical reason that God's existence can be known as a necessary condition for the laws of morality. So unlike Descartes, for example, who attempts to prove the existence of God intellectually, Kant shows how God exists as a transcendental ideal and thus replaces the search for knowledge with the need for faith.

Although the Critique of Pure Reason is one of the most abstract and difficult texts in the history of philosophy, it is a part of an extremely practical attempt to provide an orientation to life. It answers to the first of three questions that Kant asked: "What can I know?," "What ought I to do?," and "What may I hope?" It may seem that Kant's dismissal of speculative metaphysics cuts the individual off from God and other beliefs by making them unscientific or nonsensical. This, in fact, was the interpretation that the Vienna Circle made of Wittgenstein's (1922/1966) Tractatus. But this cannot be further from Kant's point. Like Wittgenstein, he was attempting to put freedom, immortality, and God beyond proof or disproof, that is, to clear away the search for unobtainable knowledge and make room for faith. Such questions are not answered by theoretical understanding. They belong in the domain of practical knowledge, of how we conduct our lives. For while science studies the objective world, including the individual as a phenomenal object, it has as its limits the bounds set by the a priori concepts of the understanding and the forms of human sensibility. Moral consciousness forms another reality, in which we can come to terms with our essential freedom of choice through the demands of the moral law. According to Kant, the scientist cannot aspire to the whole of reality, in particular the moral sphere of human experience which lies beyond rational inquiry. With this bifurcation, Kant achieved a sense in which people can be free in an objective world determined by the causal laws of mechanics, a reconciliation between the world of God and the world of humanity.

We live in two worlds according to Kant. The understanding reigns over sensuous experience, while outside of space and time the rational self stands before God in the realm of practical knowledge. It is fitting, therefore, that Kant (1788/1956) should have as the epitaph on his sadly desecrated grave the following tribute to the two sources of knowledge he held so dear: "Two things fill the heart with ever renewed and increasing awe and reverence, the more often and more steadily we meditate upon them: the starry firmament above and the moral law within" (p. 166).

Although Kant's theory of knowledge revolutionized philosophy, even sympathetic readers soon recognized that it harbored some important problems. I will mention three that serve to orient the development of thought until the time of Hegel. First, as I have argued, Kant's division of the world into the realms of phenomena and noumena appears implicitly contradictory. In applying the category of existence to the thing-in-itself, Kant seems to imply that we can have knowledge of what is defined to be beyond the mind's grasp. Even the inference from the unity of apperception to the transcendental subject is flawed. Why should consciousness imply a single ego? Second, the Kantian scheme turns upon the vision of an autonomous intellect independently creating its own world. But this formulation leads toward subjectivity and solipsism. In ethics, for example, it cuts morality off from the social context of life, while in science it overlooks the historical struggle for meaning. Why should all individuals share the same set of "objective" concepts? Why must the categories remain fixed? Third, Kant's two-world view, denying knowledge to make room for faith, put limits on reason that frustrate the whole point of philosophical inquiry, which is to know the nature of the world in which we live.

In the Critique of Judgment, Kant (1790/1951) actually provides a prospectus for the resolution of these problems. Starting from a sense of awe at the beauty of God's world, Kant proposes a teleological view of human reason. If God constructed the world according to an intelligent plan, then the idea of a supreme being can help direct reason purposefully toward a more complete understanding of life. It was this third Critique rather than Kant's earlier writings that influenced the next generation of German philosophers and poets to give form to this vision of the world (Soloman, 1983). Like the country in which they lived (which was developing from its feudal origins into a nation state), thinkers like Goete, Holderlin, and Herder attempted to explain the whole of reality as an organic unity striving for perfection. Intoxicated with the power of reason, they rejected Kant's noumenal world and the image of the isolated ego in favor of a social mind developing through history, struggling to attain an absolute all encompassing knowledge of life. Hegel's philosophy of spirit was to be the ultimate expression--and perhaps even the achievement--of this end.

Before examining Hegel's philosophy and the constructive view of mind, I shall pause to sum up Kant's position. The theory of the structured mind sketched below will be compared with the work of Lévi-Strauss and Chomsky in the next two chapters.

Unlike Descartes who presented a view of mind separated from the world, Kant's model of the self postulates an active mind that contributes the form of experience. Its three faculties of sense, understanding, and reason each define the universal and necessary organization of thought. So while smells and sounds may be of particular objects that cannot be predicted in advance, Kant shows that they must comply with our intuitions of space and time. Similarly, while we may form a variety of empirical concepts in explaining the world, the objects of our understanding are all construed within the network of categories. Even reason, our capacity to think abstractly, is limited to certain inferences. In sum, Kant developed a model of an innately structured mind that determines the form of all our thoughts and their application to experience. Kant's aim was to answer Hume's skepticism by demonstrating the possibility of a priori synthetic knowledge of the world through an investigation of the necessary and universal structures of the mind. However, in order to achieve this philosophical goal, Kant postulated an ahistorical model of an autonomous individual intellect evenly distributed among all people. According to this scheme, both the laws of nature and the rules of moral conduct can be regarded as a logical feature of human reason. In the following chapters I will argue that both Chomsky and Lévi-Strauss share this interest in the form and limits of thought and have developed similar models to Kant's syntactically prefigured mind.

The German Romantic Philosophers

Despite the influence of the Critique of Pure Reason, the German Romantic philosophers, rather than being sobered by its warnings, again addressed the boundless quest for knowledge, ironically, it seems, taking Kant's critical philosophy as the impetus for a rejuvenation in speculative thought. While staying true to the Kantian conception of universality and pure thought as an a priori construction of the mind, they proposed the rejection of the thing-in-itself as a contradictory and impossible construction. Kant's transcendental subject also was replaced by a more encompassing notion of a "world spirit" or social mind. Reality was not fixed for all time within the heads of individuals, but was a socially projected stage, a place to live and experience through a set of historically evolving concepts. Kant's transcendental idealism thus evolved into an absolute idealism, which free from the conception of the noumenal world placed no limit on the aspirations of human knowledge. Indeed, under Schelling and Romantic poets like Holderlin, the notion of a transcendent deity and an original creation is replaced by a vision of God working creatively and immanently within the universe (Soloman, 1983). Human beings are the agents and consciousness of this progress, expressing God's perfection in their aesthetic endeavors.

In many ways this purposeful image of men and women working in a creative universe is the absolute antithesis of structuralist thought. Lévi-Strauss and Chomsky, for example, both turn a pessimistic eye toward visions of "social progress" and lament the lost innocence of simpler cultures. It is only in Piaget's (1918/1977) writings that the reader can find a sense of development and a concept of God defined implicitly within life. Such, broadly speaking, are the guiding themes of these two views of mind.

Fichte takes the rejection of the thing-in-itself as the premise of his philosophy (Soloman, 1983). In an attempt to salvage the moral primacy of life from the Newtonian model of nature and the "mechanical" image of the mind presented in the first Critique, Fichte sought to place all the categories and principles of Kant's three main works into a single logical order. His aim was to formulate a comprehensive and systematic explanation of the entire range of human experience. This, he announced, was the task of raising philosophy to a science--wissenschaft--and elevating the worth of the individual above that implicit in the impersonal demands of Kant's practical reason (Soloman, 1983). It also incorporated a richer conception of nature as an organic whole clothed in beauty and mystery and a sense of the wealth of humanities cultural development through history. In all it spoke for an epoch when the human spirit was to be awakened to the unity of the world and the possibility of a life that comprehends the whole of experience integrated within a single system of knowledge.

Since conceptual thought was recognized to have fixed limits, Fichte proposed that the absolute could only be apprehended through some pure intellectual intuition. In a similar manner, Jacobi combined a belief in the existence of a non-rational power of immediate apprehension with a measure of hostility toward the understanding, which he thought imposed a fake and restricting mold on nature. As Hegel (1827/1975) quotes him,

> what is absolutely and intrinsically true is not got by way of reasoning and comprehension; both our immediate consciousness of ourselves and our conscience are the work of a secret something which in heart understanding and sense combine. Concepts rather than embalming the living really turn it into a corpse. (p. 315)

Schelling followed Fichte in attempting to systemize Kant's philosophy and "raise" it to the level of a science. However, he rejected Fichte's attempt to derive all human experience from the primacy of practical reason. Fichte, he argued, had overlooked the teleological synthesis of Kant's third Critique. Accordingly, Schelling tried to establish the identity of nature and spirit through the intuition of religion and art (Soloman, 1983). As we shall see, Hegel's contribution was to show that this task itself depended upon recognizing that the various forms of consciousness throughout history were striving to realize this ultimate sense of identity. More importantly, though, Hegel rejected all efforts of his predecessors to replace the intellect with intuition. All around him, he argued, people looked for truth in shallow ideals, in religious mysticism and romantic intuitionism, in common sense and the finite understanding, anywhere to avoid the labor of genuine conceptual comprehension. But spirit could not be satisfied by anything less than a true science. As Hegel (1807/1977) scathingly puts it in criticizing those who believe that truth comes as some form of religious vision,

> such minds, when they give themselves up to the uncontrolled ferment of [the divine] substance, imagine that, by drawing a veil over self-consciousness and surrendering understanding they become the beloved of God to whom He gives wisdom in sleep; and hence what they in fact receive, and bring to birth in their sleep, is nothing but dreams. (p. 6)

The starting point of Hegel's philosophy is thus the rejection of an unknowable realm beyond experience and a belief in the power of reason to comprehend the world conceptually. But this level of thought--which can know the absolute--had to be developed through an historical education of consciousness. It is this journey of mind that Hegel presents in his momental Phenomenology of Spirit (1807/1977). However, before turning to this text I shall introduce some of the central concepts necessary to an understanding of Hegel's thought.

Hegel

When Descartes presented the cogito as the secure foundation for knowledge, he implicitly introduced two assumptions into philosophical thought which, in Hegel's (1873/1982) opinion, ultimately led to the "epistemologically absurd" position of skepticism. First is the belief that philosophy cannot lead to truth unless it establishes a basic set of principles from which the particular elements of experience can be deduced. I shall discuss Hegel's criticisms of this premise in the following section. Second is a dualistic metaphysics that bifurcates the subject and object within experience by setting an inner personal thinking ego over against an independent sensible world. This generates the following epistemological dilemma: "If all our knowledge depends upon consciousness, how can we ever know anything beyond our thoughts?" As Berkeley demonstrates, such a thesis encloses the individual in a realm of ideas and representations. Taken to its logical conclusion, as Hume does, it implies a state where all that really can be known is a consciousness of our immediate mental images, a solipsism of the present moment.

Hegel credits Kant with having answered this impossible reduction. Kant faced two equally unattractive possibilities. Either we can know nothing of the world, or our ideas must in some manner actually constitute reality. The second alternative, philosophical idealism, maintained the initially counter intuitive assertion that the existence of objects is somehow dependent upon our consciousness of them. As we have seen, it was Kant's Copernican revolution that molded this philosophical necessity into a comprehensible project. Kant changes the direction of inquiry from establishing a correspondence between inner ideas and an external reality to an investigation of the necessary order that the mind imposes upon experience. Metaphysics thus turns from its extravagant claims and assumptions about the world to making careful descriptions about our consciousness of experience. With this orientation comes a new conception of the self. Rather than the personified Cartesian "I," Kant identifies the transcendental subject as that activity whereby the objects of experience are constructed out of the application of concepts to intuitions.

While critical philosophy attempts to base the "objectivity" of experience on the structuring capacity of the mind, it cannot avoid skepticism, since, as Hegel recognizes, knowledge of the world is placed beyond the scope of reason. When we try to understand God, freedom, or the soul, we come up against implicit contradictions in our reasoning. For Kant this is the logic of illusion that results from applying the concepts of the understanding beyond their proper domain. The most the individual can do is establish a rational faith in the supersensible world beyond. Yet according to Hegel and the Romantic philosophers that followed Kant, there is nothing beyond experience, and this is exactly the knowledge that reason must achieve. The external world cannot be left to faith, but must be included in any systematic explanation of experience. Fichte and Jacobi, as we have seen, accepted the limitations of reason and posited some form of intellectual intuition in order that the mind can comprehend reality. For Hegel, this alternative misses the point; the whole problem, he believes, really lies with Kant's underestimation of the power of reason. The fact that contradictions emerge in the application of concepts does not imply for Hegel, as it does for Kant, that reason has reached its sensible limit. It merely indicates that thought is working with inadequate notions and that new concepts should be developed to take hold of the world and be sensitive to the nature of our experiences. So for Hegel there is no limit to the power of reason and nothing that cannot be known. In particular, a knowledge of God will emerge as the mind eventually constructs the conceptual categories to comprehend the world--or as Hegel puts it, the absolute--directly.

But if this is the goal of a systematic philosophy, as Fichte stated it (Soloman, 1983), how can the epistemological problem raised by the Cartesian cogito be solved? How can we know objects that exist beyond our consciousness? For to have knowledge of things-in-themselves implies that these elements are also dependent upon a mind for their existence. While it may seem a long way from common sense to assert that being depends upon thought, this is exactly the position that Hegel adopts. The twist that Hegel and the Romantic philosophers incorporate into the argument is to replace Kant's transcendental idealism, where perception of objects rests on a personal mind, with an absolute idealism where the existence of the world is the product of a universal mind.

The belief that mind is not a private individual possession, but an absolute and boundless ego, a "cosmic consciousness," may seem more of a religious commitment than a necessary epistemological conclusion. Indeed, Hegel's view of this universal mind does have religious elements. The word that he and his post-Kantian predecessors employs for this form of consciousness is "geist." In English this has been variously translated as "mind" or as "spirit." Each interpretation reflects the standard German usage of the term, which means either mind as separate from body, or spirit, as in the sense of "spirit of the times," "team spirit," or even "spirited." It is also commonly employed in the religious sense of Holy Spirit, to denote a mystical or ethereal presence. Hegel's common consciousness could thus be interpreted as God, and his absolute idealism could be seen as a form of progressive pantheism. The ultimate reality of the universe, in this interpretation, is of a developing self-awareness, a unity of parts in which God moves toward perfection through the increasing consciousness of humanity. In fact, there are many places in which this view appears to be endorsed by Hegel. In a section of the

Phenomenology of Spirit, called the "Unhappy Consciousness," for instance, he argues that to conceive of God as something apart from the world is to alienate the individual soul. Moreover, Hegel is critical of the traditional religious conception that sees the relationship between people and God as that of Master and slave, a subservience that strips the subject of dignity and trivializes God's purpose.

If Hegel's spirit is opposed to the otherworldly beliefs of traditional Christianity, several more recent thinkers--so called "left Hegelians"--have argued for a secular reading of geist and nave interpreted Hegel's idealism as a form of humanism. Spirit in this context is viewed as a social consciousness, the collective human ego that emerges and realizes itself through the course of history. This conception of a universal mind avoids the subjective idealism of Kant by making the elements of the world a function of its own consciousness. Spirit, so conceived, can achieve a knowledge of the absolute by coming to understand that the world is mind, a product of its own creation. The Phenomenology of Spirit is then seen as a conceptual history of the development of thought to the self-conscious recognition that spirit actually creates the world. (This secular conception of geist is supported by Hegel's earlier antitheological attacks on Christianity. In these writings, like Kant, he argues that religion is a derivative concept, to be used in the service of humanity and not to enslave people according to the whims of a capricious despot. One problem that makes the interpretation of Hegel's intent on this matter elusive is that many of his common terms are borrowed from religious concepts and pertain to religious themes. As a young man, he attended the seminary at Tübingen and clearly, despite his subsequent renunciation of these studies, carried much of the technical language he learned over into his latter works, even though, as it is argued, he drastically changed the meaning of these terms.)

While it may be that Hegel does incorporate something of the religious notion of spirit in his vision of a universal consciousness, nonetheless it is clear that geist is meant to represent humanity in the process of coming to know the world. The epistemological questions this raises concern the sense in which the notion of a social, rather than an individual, mind is comprehensible and hence the merging of the philosophical necessity of absolute idealism with a practical understanding of spirit.

From the outset, the idea of a social rather than an individual consciousness seems contradictory. Surely minds are personal. We all have our own thoughts, desires, wishes, and inner secrets that, clairvoyants aside, can be accessed only by ourselves. And yet, all human ideas are mutually comprehensible. The thoughts of one person can be understood by another, so that while each of us may have our own individual ideas, these are expressed in terms of the public concepts and socially shared structure of language. As Wittgenstein argued in the Philosophical Investigations (1958), it would be impossible to develop a private language, for even our personal use of words ultimately rests upon social agreement in judgments. It is language then that rules out the possibility of an isolated individual consciousness. Either minds live together or they cannot exist at all.

For Hegel, as for Wittgenstein, it is the social character of meaning embedded in the network of linguistic terms and concepts that makes thought possible. This fabric projects into and defines the world, creating the reality in which we live. To be a part of our experience, any object or idea must be conditioned by this matrix of categories. Here, then, is the sense of Hegel's absolute idealism. The elements of the world--chairs, books, pens, and even notions like wisdom and friendship--gain their existence only within the social nexus of meaning constituted by language. For Hegel, Kant was only partly correct when he argued that the concept determines the form of experience; he should also have extended it to the object and the contents of the world. Of course, Hegel must not be interpreted as implying that the mind is responsible for all the properties of the things it creates. The natural world has a structure that exists quite independently of thought. Even human beings have basic biological needs and desires that precede consciousness. The pens, books, and chairs we construct, while being a part of the socially determined world, also are independent objects subject to the laws of nature. It is this commonsense realism that Hegel seeks to protect within his epistemological idealism.

When Hegel talks of absolute knowledge, he does not mean a knowledge of every empirical fact or scientific law. Rather, his intention is to demonstrate that human beings can have knowledge of the world and, moreover, knowledge of this knowledge through a self-reflecting consciousness that is aware of itself as the creator of things. As we will see Hegel believes that the absolute is divided only in thought. In itself it is a unity, a system--or, rather, a system of systems--that defines the infinite properties of the world within a single whole. Absolute idealism is not the thesis that this system is generated by the mind, but is the more innocent and practical observation that the world must be captured conceptually within thought. Hegel thus presents an epistemology, which in contrast to Kant's subjective idealism demonstrates that we can have knowledge of the world through the gradual construction of categories that provide a full and comprehensive explanation of our experiences.

For Hegel the categories of thought that grasp the world conceptually do not reside in nature (as Aristotle believes) or in the structured mind (as Kant argues), but are rather the historical products of practical human activity. As we will see in Chapter 5, apart from Hegel's belief in the social genesis of mind, Piaget's genetic epistemology presents exactly the same thesis.

At first spirit does not appreciate its relationship with the world. It's initial philosophical speculations about the nature of knowledge will be naive and self refuting. Nonetheless, Hegel argues, an implicit necessity exists in this process of reflection that leads spirit through a variety of philosophical forms to the final self-conscious realization of itself as creator of the world.

Concepts, of course, do not think themselves. It is the personal minds of men and women that exercise reason through their daily thoughts and activities. The world defined by each social conception is worked out, lived through, and taken to its limits by individuals. Each viewpoint is evaluated as a self-consistent and coherent expression of experience, and, as is inevitable, it will be found wanting in some respects. The point is not to see these frustrations as marking the limits of reason, as Kant did, but as moments or epochs in the emergence of human consciousness as it experiments with the world it created. Although these various social constructions repeatedly fail, we see in the Phenomenology that spirit continues to propose new categories, new concepts, and a new world. This historical progression of forms leads spirit to a self-conscious knowledge of the world as its own creation. At this level the subject and the object, the mind and the world, are united, and spirit attains the stage of absolute knowledge. I now turn to Hegel's momentous attempt to justify these claims.

The Phenomenology of Spirit

To demonstrate the rise of spirit to the level of absolute knowledge, Hegel must explain the necessity that leads thought to more adequate forms of consciousness. Since spirit can only question experience through the particular set of concepts with which it defines the world, each stage in this development must be viewed from within for its degree of comprehensiveness. Hegel's Phenomenology of Spirit is thus an examination of the phenomena of knowledge, a systematic evaluation of spirit's consciousness of experience, as it gradually comes to appreciate the truth of its role in constructing the world.

Another way of explaining this project is to describe it as the goal of being "true" to experience. This is clarified when experience is understood, not as the passive acceptance of representations that empiricists believe in, but as the positive expression of the field of meanings generated by our conceptual structures. This is the sense of the term used in contexts like "what an experience the opera was," "the Vietnam experience," or even "my experience as a teacher." It is a recognition that we are not just observers recording an estranged reality, but are active agents who define, shape, desire, and live in the world. Likewise, when Hegel writes about truth, he does not mean the truth of propositions, but the more encompassing notion of being true to oneself, or being faithful. Consequently, the Phenomenology can be regarded as a book about truth and the goal of knowing the world without contradiction.

In his Preface, Hegel argues that previous philosophical inquiries had evolved into a kind of esoteric game. Divorced from the common sense understanding of everyday people, abstract theories were developed that had little or no contact with ordinary experience. Yet for Hegel this "natural attitude" has many valid claims to truth that can be felt in the certainty with which we live our lives. A central theme of the Phenomenology is thus to overcome the alienation between common sense knowledge and epistemology by formulating a philosophical theory that explains the truth of experience at all levels. Before embarking on this quest, Hegel posed the same question that Kant asks at the beginning of the Critique: Ought not an investigation into our ability to understand reality start with some reflection on the nature of human knowledge? However, in contrast to Kant who presents an analysis of reason prior to its employment, Hegel (1827/1975) concluded that such a propaedeutic demanded the impossible, knowledge in advance of knowledge.

> We ought, says Kant, to become more acquainted with the instrument before we undertake the work for which it is to be employed; for if the moment be insufficient all our trouble will be spent in vain. . . . But the examination of knowledge will only be carried out by an act of knowledge. To examine this so called instrument is the same thing as to know it. But to seek to know before we know is as absurd as the wise resolution of the scholastic not to venture into the water until he had learned to swim. (p. 66)

Hegel observes that knowledge often has been thought of in terms of two images, an instrument for grasping reality, and a medium that reflects or mirrors the world. Yet both models, he argues, lead to an unacceptable skepticism. By implicitly bifurcating the subject and the object, they deny the possibility of what an adequate conception of experience must provide, knowledge of the absolute. The instrument analogy, which matches Kant's use of the categories, implies that the act of knowing will alter reality. Likewise, the idea of a medium (which refers to the more passive concept of knowledge developed by the empiricist school) incorporates an element of distortion. In both cases there is no way to factor out such effects, for even the act of knowing and accounting for their contribution involves the same limitations.

Each metaphor thus preserves a distinction between the knower and the known and so presents a picture of knowledge as a bridge between two incommensurable domains, an attempt to "see" external reality within the realm of phenomena. For Hegel, true science has to develop a superior conception of knowledge that will unite the subjective and objective components of experience in order that things can be known as they are in themselves. According to Hegel, the only way to develop such a concept is to give up all preliminary hypothesizing about knowledge and jump boldly into the stream of thought. Only through the struggle to understand experience from within can spirit be led--gradually--to a form of consciousness that knows the world coherently.

Hegel's search for philosophical truth passes through three phases. In each case, rather than assessing the arguments of particular thinkers, Hegel examines a set of assumptions that underlie different theories of knowledge. While this approach "jumbles-up" the history of philosophy somewhat, it does have the merit of providing a basis upon which all epistemologies--past, present, and future--can be evaluated. Throughout the Phenomenology Hegel employs the same method. By considering each attitude to knowledge in terms of its own objectives, he demonstrates that every form of consciousness harbors implicit contradictions that ultimately prove self-frustrating. However, I will show that this series of philosophical refutations is also a learning process that leads spirit to a non-contradictory conception of truth. In the first section, "Consciousness," Hegel considers the object as the essential component in the equation of knowledge. When this proves inadequate, he turns to the subject in a section titled "Self-consciousness." Finally, Hegel examines theories based upon the indivisible fusion of the subject and the object. This is the level of social thought where spirit comes to realize that absolute knowledge can be achieved only through a self-conscious recognition of the holistic nature of experience.

Hegel begins the Phenomenology with the most obvious form of knowledge he can think of, a viewpoint he terms "Sense-Certainty." Here reality is taken to be exactly what is given in our sense awareness. No attempt is made to order or classify the data of our experience; instead consciousness is satisfied to explain the world through the "here" and "now," the particulars that make up our perceptions. Yet, when attempts are made to articulate this understanding, Sense-Certainty finds that it cannot "speak" without employing general terms. This is an important point, for Hegel argues that unless ideas can be shared in language they cannot be regarded as knowledge. So the fact that universal concepts must be employed to communicate understanding demonstrates the inadequacy of the consciousness that claims to grasp reality through the particular. This argument thus can be read as a refutation of foundationalist epistemologies that seek to ground knowledge either in the "acquaintance" with facts or the intuition of objects.

If general terms are required to conceptualize the world, then Hegel considers--in the theory of "Perception"--the argument that the things we experience are simply clusters of properties. That is, particulars are nothing but congeries of universals, and it is by perceiving these that we form concepts like red, cat, hard, and so on. Yet as Hegel argues, if particulars are only known as instances of

universals, it seems possible that two or more objects could share the same properties and thus be indiscernible. This then contradicts the assumption of Perception that the world consists of independent things. Within this section Hegel thus stages one of the central debates in the history of philosophy, the problem of universals, and in so doing considers the ideas of thinkers from Plato to Berkeley.
Hegel's argument is intended to demonstrate the truth of idealism. Empirical knowledge cannot rest on perception because the diverse properties of objects (e.g., color, smell, and taste) are fused within our judgments, not in the external world. The mind establishes a unity within experience and upon which our knowledge of reality depends.

Because the object on its own cannot provide knowledge, Hegel follows Kant in exploring the claim of idealism, that the structures found in the external world are the product of thought. In this final section of Consciousness, "Force and Understanding," Hegel investigates how the subject contributes to the act of knowing. By postulating a noumenal world of supersensible objects that somehow "cause" our sensations (which then are synthesized by a structured mind into perceptions), this view explains how the information received by different senses are united into a single idea. Yet in a parody of Kant's thing-in-itself, Hegel conjures up a bizarre image of an inverted world (similar to that produced by Descartes's evil demon) in which objects project an image that differs from their true nature. Black is perceived as white, soft as hard, and up becomes down. Hegel's point is to demonstrate that the noumenal world is superfluous to our knowledge of experience. Kant's thesis of the structured mind cannot escape the moral of the inverted world story, that a variety of contradictory beliefs about the realm of noumena can be entertained with equal plausibility. The thing-in-itself that Kant believed was a necessary condition for knowledge might as well not exist. As Hegel (1807/1977) sums up, "we see that in the inner world of appearance, the understanding in truth comes to know nothing else but appearance . . . the understanding experiences only itself" (pp. 102-103).

The problem, Hegel argues, lies in Kant's separation of the categories from experience, as if knowledge of the external world can be achieved a priori and independently of nature. Once this idea is abandoned, and with it the concept of unknowable objects, Kant's subjective idealism can be extended to a form of consciousness that recognizes that the world itself depends upon thought. From this standpoint the world is not divided and packaged within the mind by an abstract set of categories but is creatively constructed according to the practical concerns, desires, and historical interests that drive human society. Moreover, reason now can claim empirical knowledge of the world because the objects it considers are of its own making. In short, Hegel claims that knowledge of reality is possible for self-conscious beings.

Having recognized the role of thought in constructing the object, spirit now enters the phase of Self-Consciousness, and the focus of the Phenomenology turns to the more practical problem of questioning how the mind works within experience. Hegel's purpose is to prove the converse of the relationship he has just established, namely, that self-consciousness depends upon the awareness of independently existing objects. For Hegel, the self is not the autonomous "spectator" pictured in Descartes's cogito, but is an historically emergent mind that takes its shape from the external world and the intersubjective nature of social experience.

Perhaps the most important discovery in this section, that individual minds are socially created, is described in Hegel's famous Master-Slave dialectic. Briefly, self-consciousness finds that it cannot live in isolation and that to understand itself it needs--or desires--another consciousness. In the mutual struggle for recognition that ensues, the subject, whether victor or loser, still finds itself dependent upon the other. While this metaphorical battle of egos has received numerous interpretations, notably in Marx's concept of alienated labor and Lacan's structuralist reading of Freud (Harland, 1983), it also parallels one of Piaget's (1932/1965) basic themes, namely, that we can construct the idea of a personal self only by coming to terms with our own frustrated desires and the needs of others played out in a social context. The Cartesian "I" is a result rather than a precondition of experience for both Piaget and Hegel.

To overcome the alienation of consciousness that this separation of the self generates, spirit passes through the inward phases of "Stoicism" and "Skepticism," only to find in the "Unhappy Consciousness" that its attempts to emulate the otherworldly spirituality of God are frustrated by the realization of its own material nature. It is here that spirit recognizes that just as it cannot conceive the object independently of the subject, so the subject cannot live without the object. The traditional estrangement of a thinking self over against an external independent world breaks down under the examination of either of these bifurcated poles. In the remainder of the Phenomenology, therefore, Hegel tries to explore the sense in which experience can be understood as a unity.

In "Reason," the third phase of the Phenomenology, Hegel examines the claims of idealism. Since in the preceding sections he has established that this is the true theory of knowledge, his chief concern at this stage is to reject inadequate statements of this thesis. Hegel's main target is Schelling and the individual consciousness that takes itself to be the whole of reality (Soloman, 1983). According to Schelling, the world--which may be equated with God--is a unified self-creating system historically striving toward perfection. Mind and nature are not separate domains, as Kant thought, but simply different faces of the same totality. This identity of subject and object supports Schelling's claim to absolute knowledge, for as part of this single whole, consciousness can have a direct intellectual intuition of the world. The categories of thought are the categories of reality. Hegel aims to undermine Schelling's position by demonstrating first that empirical knowledge is not a matter of immediate apprehension, and, second, that humans do not acquire their intellectual abilities naturally. Taken together these themes form the foundation for Hegel's idealist thesis--to be worked out in the remaining sections of the Phenomenology--that reason is socially and historically grounded in practical human activities. On this view, knowledge of the world and its properties depends upon the gradual construction of more adequate categories that can grasp the unity perceived in commonsense within the conceptual structures of thought.

To understand Hegel's concepts of truth and knowledge, it is essential to appreciate his notion of a system, which he explains through his consideration of organic life. It is this biological paradigm that Hegel establishes for epistemology that elevates the individual (subjective) consciousness to the level of spirit and guides the Phenomenology to its conclusion. This pivotal discussion, which can be found in the section called "Observing Reason," also proves to be a significant point of contact between Piaget and Hegel. For as I shall explain, it is here that Hegel anticipates Piaget's (1952) insistence on the "whole" rather than the "part" as the basic unit of epistemology. This conviction, which pictures knowledge as a process rather than a fact, unites structure and function in a living system that reacts to the world and develops toward ever more adequate and comprehensive forms. When fully explored, this metaphor can be seen to serve the same end for both authors, supporting their shared view of the historical rise of consciousness and the ultimate equation of freedom with the life of reason.

Just as Hegel had undermined Kant's isolated individual consciousness, so in his consideration of nature he sought, like Fichte, to reject the classical view of the world based upon the Newtonian belief that all phenomena can be reduced to a set of discrete elements related through causal laws. The image of organic life that this view supports led to the antinomy of mechanism and vitalism. The former, which emphasized the structure of an organism, held that natural laws can provide a sufficient explanation for life as the sum of atomistic parts, while the latter, in rejecting casual hypotheses, postulated a creative force at work in the universe. The result was a never ending vacillation in the biological sciences between the machine and its creator, a spiral that Hegel, prior to Darwin, aimed to overcome by establishing the fundamental dynamic and evolving character of the world.

Starting with the foundationalist standpoint, Hegel demonstrates in this first division of "Reason" how any attempt to explain an individual element presupposes the system within which it is found. Just as consciousness had met the universal in describing experience from the perspective of Self-Certainty, so Hegel maintains, that in observing the organic world we must acknowledge the primacy of the "permeating processes" that define life. Classical biology, which factored structure and function into the separate areas of morphology and physiology, is superseded in Hegel's scheme by an inquiry into the active processes that link elements within a network of relationships. The dynamic character of life must therefore be represented by a viewpoint that recognizes the organismic quality of the ties between parts and the whole and attempts to phrase these in functional terms.

In Chapter 5 I will show how these arguments are paralleled by Piaget in his attempt to steer a middle course between Bergson's vitalism and the prevailing mechanistic conception of life supported by Darwinism. In particular, we shall see that the same awareness of the relationship between part and whole in the biological domain serves as the paradigm for knowledge and that Piaget, like Hegel, offers an epistemology of action in which structure and function are merely aspects of a living process. It is worth pausing to recognize that Hegel, a generation before Darwin, flirted with a theory of evolution and remarkably defined a series of developmental stages--in terms of progressive systems of organization--that clearly anticipates a theory of adaptation. Further, like Piaget, Hegel's levels of organization can be applied both to the classification of superior forms in the natural world and to the epistemological domain where they represent "truer" descriptions of experience.

The most basic kind of system is given in mechanism, the ordering of elements by external laws. Here the parts--like the planets in the solar system--are governed by outside forces that are not created through their union. In contrast, chemism, based upon the phenomena of chemical interactions (though not restricted to them), recognizes a unity established in the fusion of elements that transcends their individuality. However, while this integration produces a qualitative "whole," it still is impoverished when compared with teleological systems. Here "intelligent" purposive actions can be observed as internal compensations direct the system toward a particular end.

In the Philosophy of Nature (1827/1970) Hegel shows that the genera of species can be classified in terms of their teleological capacities, ranging from plants, which have only an external directedness--merely able to respond to the environment--to animals which demonstrate an inner sense of purpose. Yet even the higher order creatures must respond instinctively to their desires. It is only human beings, who can self-consciously reflect upon their needs, that are capable of truly free action. Ironically, this self-determination can be witnessed in the means we employ to achieve our natural ends. As Hegel (1827/1970) explains in discussing weapons, tools, and cooking utensils,

> To this extent, the means is superior to the finite ends of external purposiveness: the plough is more honorable than are immediately the enjoyments which are procured by it, and which are ends. The tool lasts, while the immediate enjoyments pass away and are forgotten. In his tools man possesses power over nature, while in respect of his ends, on the other hand, he is subject to it. (p. 747)

Although human beings have the capacity for self-conscious determination, we are also animals subject to instinctive drives. In primitive cultures where people are so immersed in the natural world that they have little or no time to reflect upon their own activities and goals, such impulses dominate life. Even in developed societies we are still motivated at times by our animalistic natures, only now Hegel argues, they function at the level of the unconscious. Expanding upon this insight in the Philosophy of Mind, Hegel (1827/1971) employs this "natural soul" to explain such diverse phenomena as dreams, sexual desire, and madness. Intelligent action serves as evidence that thought has risen above this natural base, and this, as we have seen, depends upon the construction of social relations as the prerequisite for self-conscious understanding.

The general point is that human beings have elevated themselves from the determinate world of nature through the formation of society. Through the submission of our subjective desires to the objective will of spirit, embodied in the laws and customs of the community, we can achieve rational freedom and the power of self-determination. It is this perfection of our abilities--the development of mind--to the level of autonomy that is the mark of the ethical citizen.

For Hegel, as for Piaget (1980a), the emergence of reason is not a matter of chance but follows a logic that is immanent in experience itself. As we will see in Chapter 5, Piaget offers a similar picture of the necessary and rational development of mind--phylogenetically and ontogenetically--stretching from the biological root of behavior to the achievement of self-directing, autonomous thought.

However, while prestaging these similarities between Piaget and Hegel, it is also important to recognize a fundamental difference. According to Hegel, biological goals belong to the species, not to the individual. Just as in history, where the cunning of reason works behind the conscious intentions of particular agents, so in the organic world the behavior of a part can be understood only in terms of the logic of the system. Piaget, I will argue, parts company at this point, for while he professes to uphold the primacy of the system, in both the biological and epistemic spheres, he presents the individual as a solitary center of activity. It is this underevaluation of the social context of thought that is the weakest and the most commonly criticized link in Piaget's epistemology (Rotman, 1977).

For Hegel, the community always comes first. This is as true of ethical concerns as it is for epistemological questions. Just as society is a necessary condition for self-consciousness, so it also provides the arena in which all desires and behavior gain meaning. Kant's emphasis on the individual and the power of reason to determine action through a consideration of moral principles, denies--in Hegel's opinion--the sentiments and emotions that are more central to the good life than the abstract concept of duty. Hegel thus viewed Kant's ethics and his ideas about God as fundamentally alienating. In their place, in the later sections of the Phenomenology ("Spirit" and "Religion"), he seeks to demonstrate how the shared values and customs of the community--sittlichkeit, rather than otherworldly beliefs, define religion and morality. Individuals do not exist in the world alone, cocooned with natural rights and freedoms, but must be educated--raised to a level of perfection (bildung)--where they can recognize their role within society, rationally and self-consciously accepting its values as their own. Likewise, religion must be seen as a quest for the identity of God with spirit and must escape the traditional opposition between the finite self and the absolute as favor of a conception of the world immanently aware of itself through the thoughts of men and women.

Talk of freedom and autonomy often seems cheap in contemporary society, as if it is the natural right of all. For Hegel (1807/1977), these are achievements to be earned by the individual as they have been acquired by spirit, through a phenomenology of mind. This is both an epistemological and a practical point. Human beings cannot exist alone. It is only in society that self-consciousness, freedom, and self-determination are possible, and the individual can expect to expend the same labors as spirit in acquiring his understanding.

> Science must present the pattern of this whole developmental movement in its complete detail and necessity as something which has already sunk down and become an aspect and possession of spirit. Its end is spirit's insight into the nature of knowledge. Impatience demands the impossible, the achievement of this end without the means. . . . But because the substance of the individual, and even the world of spirit, has had the patience to go through these forms in the long stretches of past time, and through the colossal labor of world history . . . and because it could not with less labor have reached the consciousness of itself, so obviously the individual mind cannot hope to grasp its own substance with less labor. (p. 17)

For Hegel, then, individuals must be educated through a gradual initiation into the social categories of thought developed by spirit. That is, "ontogeny must recapitulate phylogeny" in the construction of mind.

Throughout the Phenomenology Hegel proposes to reveal the truth of idealism in the form of consciousness that directly grasps the world. This, of course, is Hegel's own epistemology that he presents in the final, and characteristically obscure, section, "Absolute Knowledge." What spirit has found through its labors is that all concepts are socially constructed in the historical struggle for meaning. Each form of consciousness makes two complementary claims, first an ontological pronouncement, setting out what it takes the nature of the world to be, and, second, the epistemic principles by which it proposes to gain access to this reality. Reflecting upon the failure of these efforts, spirit finally sees the futility of this enterprise. The world does not lie beyond our concepts, as Kant thought, and our knowledge of it is not one of appearances. Reality cannot be viewed as we see an object, as the mirror and instrument metaphors of Hegel's Introduction suggested. Rather, the thesis of absolute knowledge is the claim that the systematic structure of the world may be captured conceptually by reason, so that in thinking through the categories, spirit has direct access to the nature of reality. In short, the structure of the world is known through a rational construction of experience.

Once again, this is not the claim that we can know all the facts and properties of nature, but rather that the philosophical demonstration that knowledge of the world is itself possible. It is the form of consciousness that in contrast to the skepticism of previous epistemologies is self-consciously aware of its grasp of the absolute. Having achieved this level of philosophical awareness, spirit's education is complete, and Hegel can turn in the Logic to the systematic explanation of the world through an examination of our concepts.

Why, it may be asked, must Hegel go through this entire process? Why not simply state the result at the outset? In a sense this repeats the question that Hegel poses at the beginning of the Phenomenology, namely, can a preface be written to a philosophical work? Unlike the mathematical model that Descartes employed, in which the truth was seen to reside in a stock of clear and distinct ideas, Hegel argues that the categories suitable for the scientific study of knowledge must be open to self-examination. That is, conceptual schemes have to be evaluated in the context of their employment. Truth cannot be found in a static set of propositions but lives in the dynamic interrelationship of the whole, the total system of ideas that defines our conception of the world. Consequently, Hegel (1807/1977) argues, conclusions without the process of arriving at them cannot be philosophical. "By itself the end is just a lifeless universal, just an orientation to the mere impulse which lacks its actuality; and the naked result is the corpse which has left the orientation behind" (pp. 2-3).

For philosophical knowledge to rise to the level of wissenschaft, truth must be unconditioned, that is, not determined by current or external criteria to the act of knowing. Thus, it is the total and overall sense of comprehension provided by consciousness that becomes the criterion for its own adequacy. Accordingly, the coherence theory of truth--the feeling of self-satisfaction with a particular moment--drives spirit onward. Coherence, however, should not be understood as the conformity to a single standard, since that too would be to impose a static principle on thought. Rather, the standard itself changes throughout the Phenomenology as spirit necessarily projects and attempts to satisfy its own claims to knowledge. Unlike traditional epistemologies, then, Hegel substitutes the sense of personal frustration and the desire for a complete and comprehensive awareness of experience as the criterion of adequacy that moves thought forward to more encompassing and self-consistent forms.

This concept of an inner necessity--implicit in all acts of knowledge--underlies Hegel's view of the universe as a living process evolving toward its implicit potential. This biological metaphor of development--bildung--has been translated variously as culture or education. In essence, it meant the cultivation of spirit and describes the rise of consciousness, both socially and individually, to the level of reason.

Inextricably tied to the image of bildung is Hegel's concept of the dialectic, the philosophical process by which truth is established. Originally it simply meant the art of conversation and was developed by the Greeks as a method of entertaining competing points of view in the search for truth. Kant, who Hegel credits with restoring the dialectic to its proper philosophical position, formed a somewhat different notion. As we have seen, the dialectic was employed by Kant as the logic of illusion and used to explain how reason could be led into the apparently absurd position of holding opposing viewpoints. Hegel's advance was to establish a concept that incorporated both of these images, by defining the dialectic as the process that leads toward truth through the overcoming of contradictions.

Although this dialectical deduction often has been interpreted as a logical proof (Soloman, 1983), Hegel does not make this claim. Nor does he believe that the Phenomenology is a staircase to absolute knowledge, as if each form of consciousness must unfold in a hierarchical movement toward truth in only one way. Nothing could be more alien to Hegel's scheme. The plurality of life and forms of consciousness is simply that. To suggest that there exists some external structure that ranks and directs consciousness according to its epistemological adequacy is to impose an extrinsic order on the growth of spirit and replace the internal necessity of development with some abstract and philosophically alien principle. For instance, according to Hegal (1827/1975) Fichte's triadic form, thesis-antithesis-synthesis, is an attempt to provide an exterior dynamic that will generate successive modes of thought. At times it appears that Hegel adopts these or similar movements in the Phenomenology. The book is divided into three parts, (a) consciousness, (b) self-consciousness, and (c) reason, each with three subsections. The first chapter emphasizes the object, the second the subject, and the third fashions a unity out of the two. However, upon closer examination not all of these triadic arrangements exhibit the opposition or reconstitution of moments one would expect from Fichte's argument. It is not that these steps never fit the triadic sequence; at times they do. The point is to avoid rigid generalization that would detract from the sense of internal adequacy as the driving force of spirit's development.

The dialectic is nothing more than the simple, but philosophically honest endeavor to think through all our ideas about the world. It is a demonstration or journey through a set of experiences that shows the incompleteness or one sidedness of all forms of thought by revealing the implicit contradictions that each harbors. Through the process of "determinate negation," which is opposed to indeterminate negation--the simple rejection with no directive--the inadequacy that frustrates a particular moment, at the same time is both rejected and overcome by giving birth to a new set of concepts. This is the process of aufheben, the moving on while preserving or conserving that which has gone before.

All these images, the bildung metaphor, the dialectical progression toward truth, and the self-realization of spirit, form an interlocking network of concepts that drives the developing consciousness through the various phases of the Phenomenology. A sense of this unity can be appreciated from one of the most vivid metaphors in Hegel's (1807/1977) Preface.

> The bud disappears in the bursting forth of the blossom, and one might say that the former is refuted by the latter; similarly, when the fruit appears, the blossom is shown up in its turn as a false manifestation of the plant, and the fruit now emerges as the truth of it instead. These forms are not just distinguished from one another as mutually incompatible. Yet at the same time their fluid nature makes them moments of an organic unity in which they not only do not conflict, but in which each is as necessary as the other and this mutual necessity alone constitutes the life of the whole. (p. 2)

As he sat writing the Phenomenology of Spirit Hegel sensed that he was a man of destiny, completing in the pages of his book what the great world figure of Napoleon was achieving for humanity. The "cunning of reason" had used Napoleon to establish a new federation in Germany governed under the ideals of the French Revolution--"liberty, equality, and fraternity"--and Hegel, while watching this man at the gates of Jena, was to be the instrument of spirit's self-conscious awareness (Soloman, 1983). Spirit was to be realized in the world, conceptually in the pages of the Phenomenology and practically in the streets of a new Germany. It was a time of birth, for a new Republic and a new form of knowledge. People had become alienated from God through the institutionalization of religion, just as they had become separated from nature through the science of Newton. Faith in dogma and intuition could no longer sustain the purpose and meaning of life. Society had been led through gradual changes to a new vista, to a life based upon reason and the rationality of the universe. Spirit had at last come to see itself for what it was, a self-conscious unity, a world that creates itself and knows itself as creator.

> Besides, it is not difficult to see that ours is a birth time and a period of transition to a new era. Spirit has broken with the world it has hitherto inhabited and imagined, and is of a mind to submerge it in the past, and in the labor of its own transformation. Spirit is indeed never at rest but always engaged in moving forward. But just as the first breath drawn by a child after its long, quiet nourishment breaks the gradualness of merely quantitative growth--there is a qualitative leap, and the child is born--so likewise the Spirit in its formation matures slowly and quietly into its new shape, dissolving bit by bit the structure of its previous world, whose tottering state is only hinted at by isolated symptoms. The frivolity and boredom which unsettle the established order, the vague foreboding of something unknown, these are the heralds of approaching change. The gradual crumbling that left unaltered the face of the

> whole is cut short by a sunburst which, in one flash, illuminates the features of the new world. (Hegel, 1807/1977, pp. 6-7)

Conclusion: Kant and Hegel

In discussing Hegel's (1807/1977) Phenomenology of Spirit, I have strayed from the central objective of this chapter, a comparison of Kant's and Hegel's epistemologies. In a sense this was inevitable, for as Hegel's arguments show, comparisons cannot be made piecemeal by reference to the main results and conclusions of each system. A theory must be examined from within--on its own terms--for its philosophical coherence. However, we now are in a position to reflect on the major differences in the structured and constructive views of mind that will be of service in contrasting the theories of Chomsky, Lévi-Strauss, and Piaget.

Although Hegel criticized Kant's thought on many fronts, three themes are particularly pertinent to this study: First, Hegel's rejection of Kant's inquiry into the nature of reason and the deduction of the categories prior to experience; second, Hegel's establishment of the dialectic as the instrument for the constructive development of thought; and, third, the dismissal of Kant's philosophical individualism in favor of a social theory of mind and a vision of life as a unified evolving system. Taken together these arguments transform Kant's model of the structured mind (which characterized the individual intellect as being innately programmed to construe the world through a fixed set of categories) into Hegel's view of the social construction of thought and the rational development of reason. I will briefly discuss each point and indicate some of the parallels to be drawn with the positions advanced by Lévi-Strauss, Chomsky, and Piaget.

The structured view of mind attempts to describe the nature of experience in advance of inquiry. Looking back on the history of philosophy, the motivation for this move is clear. Since the universality and necessity needed to explain our knowledge of the world could not be found in experience or satisfactorily accounted for by invoking the power of God, it naturally was seen as the contribution of the subject. Accordingly, Kant, Lévi-Strauss, and Chomsky all seek to make claims about the mind's structure on the basis of logical categories somehow "inferred" from the nature of thought. There is a sense in which the point of the activity being investigated is unimportant. Chomsky is not concerned that the purpose of language is communication, and Lévi-Strauss is not particularly interested in the social function of myth. Like Kant, their fundamental objective is to determine the universal and necessary structures implicit in thought to reveal the structure of the mind.

While Hegel (1827/1975) compliments Kant for his efforts to bring the traditional methods of philosophy into question, he severely criticizes Kant's attempt to determine the transcendental features of thought prior to experience. According to Hegel, this is the misguided endeavor of trying to gain knowledge in advance of knowing. The analysis of thought, Hegel maintains, is only possible within the context of our attempts to understand experience and acquire knowledge of the world. Kant's method was thus an illicit attempt to define the categories of thought independently of their application to experience. But for Hegel (1827/1975), knowledge and criticism must go hand in hand in the dialectic development of the mind.

> The forms of thought must be studied in their essential nature and complete development. They are at once the object of research and the action of that object. Hence they examine themselves, in their own action they must determine their limits, and point out their defects. (p. 41)

For both Hegel and Piaget, thought cannot be divorced from experience. The constructive mind generates the universal and necessary categories as it experiments with its view of the world. The mind thus depends upon the purpose of our actions and the nature of the world in which we live. This is why Piaget, like Hegel, charts the development of concepts in the history of ideas. It is the novel premise of genetic epistemology that this same interactive logic of intellectual growth can also be observed in the cognitive development of children.

This brings us to the second point, the construction of the categories. To recall, Hegel's (1827/1975) main criticism was that Kant had merely abducted these concepts from the "tables of logic" without showing either their necessity in thought or their completeness for explaining experience. All Kant offers, argues Hegel (1827/1975) in the Logic, is an empirical derivation, as if the categories could be accepted as a lucky find. The whole argument was, in Hegel's mind, a "philosophical scandal" that should be replaced by a dialectical deduction of concepts as they reveal their adequacy in describing experience. In a similar vein, Piaget (1970) criticizes several structuralist thinkers--in particular Lévi-Strauss and Chomsky--for failing to explain the genesis of their constructs. Such "inauthentic" structuralisms he argues attempt to rest intellectual mechanisms upon innately acquired capacities and so pass the question of mind to evolutionary biology. Yet for Piaget, unlike Lévi-Strauss and Chomsky, the nature of thought could not be left to the "blind chance" of Darwinianism. Mind for Hegel and Piaget has to be explained as a rational construction through the logic of the dialectic.

Kant argued that the understanding imposes its conceptual structure on experience. It packages our ideas and plays neat analytical games with them. When the categories are applied beyond experience, a series of contradictions arise which, Kant believes, demonstrate the limits of theoretical understanding and thus the inadequacy of human thought for the task of metaphysical speculation. Kant therefore stopped reason at the point where it brought into question the unity of the world. It was as if, Hegel jests, out of some ironic respect for the thing-in-itself Kant was not prepared to see reality undermined. Chomsky makes a similar argument when he distinguishes between problems and mysteries. While the former are the legitimate concern of science, the latter--like the question of free will (or the creative use of language)--are beyond the rational capacities of human beings. According to Chomsky, men and women are simply not "wired" to understand mysteries of this kind.

But why should thought be immediately criticized for producing opposing views? How can we know so surely that contradictions that arise in reason do not apply to the world? In Hegel's (1827/1975) eyes, Kant had set up the problem well. Hegel also saw the antinomies as legitimate contradictions, but he rejected the inference that because the categories yielded implicit oppositions they were thereby inappropriate to the task of metaphysics.

> The profundity of this point of view is matched by the triviality of its resolution, which consists only in a tenderness for the things of the world. It is not supposed to be the essential being of the world, but only the thinking reason, the essential being of spirit, which has the blemish of contradiction in it. (p. 48)

Kant's great service, in Hegel's estimation, was to have recognized that the dialectic is a necessary activity of reason, but he claimed that Kant had failed to appreciate the significance of his own achievement and never came to terms with the real meaning of his own antinomies. Kant's fundamental mistake was to think that contradictions result from the illicit use of concepts. The truth is that concepts break down within experience. Contradictions are present in every view of reality until spirit attains the level of absolute knowledge. So far from marking the terminus of thought, the oppositions discovered in our conception of the world are fashioned by the dialectic into new, more encompassing forms of understanding, a process that is graphically illustrated by many of Piaget's experiments, where the conceptual schemes of children, that at one stage of development appear to explain experience coherently, are found to harbor internal contradictions. Under the force of these conflicts, new logically related categories are constructed, until a fully comprehensive and consistent conceptual understanding of the world is achieved.

Hegel's elimination of the thing-in-itself turned critical philosophy into absolute idealism and so enabled the categories of thought to become the categories of the real. Logic--the science of pure thought--thus studies the manifestation of reason as it asserts itself through the history of spirit. It is a system of categories that presents successive definitions of the absolute, as each conceptual scheme unfolds into progressively more adequate moments. So unlike Kant's system, the categories are not fixed or, as Hegel argued, accepted uncritically. They are open to revision and reformulation. In fact the Phenomenology can be viewed as a deduction of the categories, a demonstration that they are in fact constructed through the necessity of dealing with experience.

What Hegel shows through this teleological process is that every form of consciousness is an integral part of a vast tapestry of human experience, each expression of which presents an indivisible perspective on reality. The stage of absolute knowledge, from which spirit feels no demand to progress, brings the realization that the world is formed by ideas and that there are as many different realities as there are languages and conceptual systems. Absolute knowledge is not a meta-conception that transcends each of these forms, but a recognition, as Findlay (1958) calls it, of the relative absolutism of spirit. For it is in this plurality of thought that spirit comes to identify itself as creating and understanding the world.

Finally, I shall briefly consider Hegel's criticism of Kant's epistemological individualism. Like most philosophers since Descartes, Kant assumes the existence of a private thinking ego, which through the acquisition of language can communicate with other minds sharing similar conceptual structures. The primacy of the subject is not simply an epistemological issue. It also concerns important practical questions. For example, thinkers like Locke and Hobbes attempt to explain the origins of society in terms of social contracts made between individuals as a means of ensuring mutual well being. Society was thus seen as an intentional construct set up by pre-existing, self-conscious, yet independent intellects. In Lévi-Strauss's theory of society, to be discussed in Chapter 3, it again is the individual who establishes the community, only this time through innate unconscious principles biologically encoded in the mind.

For Hegel this attitude inverts the true relationship between society and self-consciousness. As Hegel argues in his master and slave parable, it is only the existence of social relations that make self-conscious thought possible. Piaget, as I will show in Chapter 5, establishes a parallel claim by demonstrating that the concept of self is formed by facing the frustration of our desires and recognizing the independent needs of other minds within a social context. Even so, a fundamental difference remains. For Piaget has developed a model of the individual mind manufacturing its own world through a personal construction of the categories. While Piaget recognizes the role that others play in the mediation of ideas, he argues that each child must nonetheless be the originator of their own concepts. In Chapter 5 I will argue that this "radical" constructivism fails to take into account the socially defined nature of our experiences. The world we live in, the objects and events we perceive, all our needs and aspirations, are shaped by the publicly constructed language through which we think. Thus, to emulate Hegel, I will propose a socialization of Piaget's theory and a model of a socially emerging consciousness. I shall argue that such a system-oriented constructivism will address many of the criticisms levelled against Piaget's theory, while providing a more sensitive account of the interactive role between the individual and society. Moreover, it is just this theoretical orientation that is captured in Richard Peters's approach to education, to which I will turn in Chapter 6.

The points to recognize are the following. For Kant the categories only confer form on our perceptions and so remain one-sided and abstract. As the innate determinant of individual thought, Kant's "subjective" objectivity ultimately rested upon the empirical claim that humans live in the same world and share the same structured mind. Hegel bridged this epistemological gap between the individual and reality by uniting subject and object and proving that the universality of thought was a social construction. The Phenomenology thus can be seen as a book that attempts to overcome epistemological alienation by showing that through reason we indeed can know the world as it is. This is also a practical point. For Hegel the French Revolution made possible a state where consciousness was aware of its own freedom. Alive to the power of reason and independent of external constraint, it recognized the free mind as the creator and the life of the world in which we live. Freedom and rationality are thus fused in the realization that it is spirit, the mind of humanity, that constitutes our reality, not some alien or otherworldly being. This is the truth of experience that spirit--the creative social mind--is driven toward in its struggle to achieve a fully comprehensive understanding of the world.

It is the arrogant, audacious, and yet tumultuous claim of Hegel's thesis that as he sat writing the closing pages of the Phenomenology he was not merely describing the end of human history but, insofar as he achieved a level of consciousness that finally grasped the world as it is, he actually was completing it.

CHAPTER 3
LÉVI-STRAUSS AND THE STRUCTURALIST MOVEMENT

Introduction

Structuralism is a philosophical theory of mind (Gardner, 1981). It maintains that all individuals employ abstract classificatory systems, which like the rules governing language exist at a deep level in the cognitive unconscious. Since it is claimed that these categories cannot be explored through the process of introspection, structuralism aims to provide a scientific analysis of the mind by observing the manner in which human beings organize their cultural world (Gardner, 1981).

In this chapter I will discuss the emergence of this largely French outlook and assess the contribution of its main proponent, Claude Lévi-Strauss. Particular attention will be paid to the way that Lévi-Strauss crafted the structuralist method from the ideas of Ferdinand de Saussure and Roman Jakobson. Although much of Lévi-Strauss's work is of a highly technical and esoteric nature, I shall present a few examples of this methodology in order to illustrate the character of his research. This exposition then will be used to explore the parallels between Lévi-Strauss's theory of mind and Kant's critical epistemology.

In later chapters I will show that although the work of Piaget and Chomsky lies outside of the French structuralist tradition, since each proposes to capture the human mind in mathematical models of deep cognitive structures, there is sufficient warrant to consider them theorists in the same movement. Moreover, like Kant, all three maintain a basic theoretical commitment to methodological individualism. In the case of Lévi-Strauss and Piaget their emphasis on the subjective unconscious developed as a reaction to the authority of the Durkheimian tradition within the French university system and the tide of nationalism that swept Europe during the first half of the 20th century. Similarly, in Chapter 4 I will argue that Chomsky's focus on the subject also can be seen as a consequence of his political individualism and the rejection of a parallel social philosophy.

Since the aim of this dissertation is to present a model of the socially constructive mind based upon Hegel's concept of spirit I will reject the structured mind thesis by criticizing Lévi-Strauss and Chomsky for their "biologism." In particular, I shall argue that Lévi-Strauss employs an impoverished "linguistic" model of mind--derived from his readings of Saussure and Jakobson--to reduce all cultural phenomena to a number of underlying oppositional forms. The result is a series of mathematical "deductions" in which social practices are forced into logical categories at the expense of their meaning. In the end, like Chomsky, Lévi-Strauss presents a "grammar" of mental structures that is divorced from the social context and intentional nature of human activity.

The Origins of Structuralism

Although the structuralist debate dominated French intellectual thought from the late 1950s to the early 1970s, its chief practitioners all seemed to be ambivalent about the prospect of raising this outlook to the status of a philosophical theory or world view (Harland, 1983). None of the authors popularly associated with this period believed themselves to be a part of a theoretical movement or school of thought. Nor did they consider themselves bound together by any particular doctrine or motivation. In fact, several took pains to disassociate themselves from the structuralist label. Foucault, for instance, claimed that he ignored all the reviews of his work in which he is termed a structuralist, since in his book, The Order of Things (1966), he never once uses the word (Harland, 1983). Even Lévi-Strauss, who for many was the originator and leading figure in structuralist thought, abandoned the term when, just as Peirce had experienced with "pragmatism," its popular use seemed to dilute his original insights.

Because structuralism failed to formulate any theoretical foundations, many commentators (e.g., Gardner, 1981; Pettit, 1975) have referred to it as an intellectual fashion or fad. Like other areas of French life, it appears to the Anglo-Saxon world as yet another product of the capricious Latin mind--an attitude that was inseparably caught up in the intellectual unrest that swept France during the 1960s. Critics point to the seemingly universal popularity that structuralist ideas enjoyed in almost all areas of inquiry; anthropology, linguistics, mathematics, the social and physical sciences, literary criticism, and philosophy all profited from its insights (e.g., Piaget, 1970). However, while it provided the stimulus for this proliferation of creative thought, the ideas it generated remained all too eclectic. There appeared to be no way of adequately integrating the work of theorists like Lacan, Barthes, Althusser, Foucault, and Lévi-Strauss in a manner that could permit the distillation of a common set of mutually acceptable principles. It was as if the structuralist paradigm had emerged on the intellectual scene stillborn.

The work of these authors came to be viewed as projects within a general structuralist orientation. So, while not completely reconcilable, they nonetheless bore a Wittgensteinian "family resemblance" to one another. Individually, their ideas were presented in distinct intellectual traditions and addressed different theoretical concerns. Collectively, however, their approach to these problems displayed a similar commitment, an acceptance of an inner unobservable organization that can be deduced by careful inference and formally expressed in mathematical models. As Barthes (1972) argued,

> Structuralism is neither a school, a movement, nor a vocabulary, but an activity that reaches beyond philosophy, that consists of a succession of mental operations which attempt to reconstruct an object in order to manifest the rules of its functioning. (p. 213)

If the adoption of the structuralist attitude by such a wide range of theorists during this period prompted its public acceptance as a new philosophical outlook, its emergence in the French academy must also be explained. This seems especially pertinent if, as Piaget (1970) suggests, we accept it as an attitude that had long been implicit in the physical and biological sciences, rather than just a spontaneous product of the 1960s.

Etymologically, the word "structure" is derived from the Latin struere, meaning "to build," and, as with the construction of buildings, it implies some notion of an interior function. Perhaps because of the metaphorical power of this image, the idea of structure first became an important concept in the developing natural sciences (Foucault, 1966). In particular it supported the emergence of a new biological model of organic life that first challenged the traditional classificatory scheme by suggesting the possibility of an interior organization. In place of the taxonomic ordering of species pictured by the "great chain of being," this new idea stressed the essential but concealed inner functions of the organism and attempted to relate them to external behavior. Thus, the hidden matrix of rules, rather than surface similarities, became the object of scientific study. Ultimately this led to Curvier's conception of the identity of function as a criterion for the relationship between species (Mason, 1962), even in those cases where ostensible characteristics bore no resemblance. The success of this metaphor in the biological sciences generated similar ideas in other domains. Linguistics, economics, and the newly founded area of psychological investigation all profited from the notion of an interior mechanism (Foucault, 1966). As with biology, the structural model suggested a system that could be formalized in mathematical terms to achieve the explanatory power that eluded surface level generalizations. It promised the substitution of reason for causality and the development of a theoretical understanding that could give form to the confused plurality of experience.

As Foucault (1966) shows, contemporary interest in the inner structure of the world--considered as either a physical or a cultural phenomena--has antecedents that stretch throughout the Western intellectual tradition. In fact, it is because of their standing in relation to this rich heritage that a comparison of many structuralist authors is so difficult. Even so, the 1960s can be identified as an era in which three powerful yet distinct movements converged to mold a new attitude toward the social sciences. Each carried the seeds of the structuralist method and offered a model of analysis that went beyond the surface phenomena to the underlying organization and internal rules that supported them.

First, in Marxism critics were impressed by the power of the laws of society's infrastructure--the means and methods of economic production--to account for the variety of social organizations that exist and evolve historically (Harland, 1983). In particular, Lévi-Strauss and Foucault have acknowledged their debt to Marx and his insight that social thought is determined not by the individual conscious ego, but by the underlying conditions of life. Further, contemporary Marxists, like Althusser, have attempted to rejuvenate the anti-individualistic elements of Marx's account and elaborate a theory of economics based in the reality of social structure (Harland, 1983).

Second, the Freudian thesis that all mental life is determined by subconscious psychic processes which can, when analyzed, reveal desires and motivations hidden from consciousness complements Marx's explanation of social phenomena with a concomitant reduction of individual thought (Hawkes, 1977). Lévi-Strauss (1955), for instance, was impressed by Freud's endeavor to describe the apparently unrelated tangle of human behavior in terms of a coherent and systematic organization of mental rules. Lacan (Harland, 1983) attempts to further this task by expanding upon Freud's earlier writings. By focusing upon the essential relation existing between the unconscious and language, he attempts to dispel the popular Anglo-Saxon "myth" that the unconscious mind is dominated by primitive, animalistic emotions.

The third and most important influence in the growth of the structuralist movement is provided by the work of Ferdinard de Saussure. Often described as the "father of structuralism," Saussure (1915/1974) originated the scientific study of language by identifying it as a rule governed system of signs and even claimed that one day it would "become the master-pattern for all branches of semiology" (p. 16). Since it is this insight that provided Lévi-Strauss with the key to a structuralist science of culture, I will present Saussure's model of language and discuss the development and application of his within the structuralist movement. Two themes will be stressed. First, I will discuss the similarity of Saussure's concept of language to Emile Durkheim's view of society. Lévi-Strauss (1967) regarded himself as the intellectual heir to the French sociological tradition originated by Comte and developed by Durkheim, and it is clear that he believed his application of Saussure's ideas somehow completed this movement. Second, I shall trace the development of the structuralist method of analysis through Roman Jakobson's (1962) application of certain Saussurian concepts. Jakobson is a pivotal figure in the history of structuralist thought, and his influence can be seen in the work of almost all its leading proponents.

French Sociology and Saussure

Although there is no mention of Durkheim in Saussure's Course in General Linguistics (1915/1974), some clear and important comparisons can be made between their respective ideas. In this section I will discuss the development of French sociology from Comte to Lévi-Strauss and point out the similarities between Durkheim and Saussure. Later I will describe how Lévi-Strauss applied some of Saussure's central concepts to extend Durkheim's analysis of society. More generally, following Clarke (1983) I will show that Lévi-Strauss's ideas emerged in a reaction to the intellectual authority of Durkheim (and Bergson), whose thought dominated the French academic system during the first half of this century. It is against this background that the development of the structuralist movement must be viewed.

August Comte is perhaps now best known for coining two famous terms: "positivism," by which he meant the establishment of a scientific attitude, and "sociology," the study of society considered as an independent organized whole (Manicas, 1987). The central theme of Comte's system is that all knowledge--and all societies--develop through three distinct phases. From an initial theological orientation, thought progresses through a philosophical period to the level of scientific reason. (In Chapter 5 we will see how this scheme broadly parallels Piaget's theory of mind.) Rejecting the individual subject as a "psychological and philosophical fiction," Comte compared society to a biological organism, functioning as an integrated system over and above its individual members. This social whole gradually evolves toward positivism, the state that Comte believes is personified in the life of 19th century France.

While Durkheim lauded Comte's belief in the irreducibility of social laws to psychological facts about individuals, he rejected the notion of an evolutionary teleology. Moreover, against Spencer (the other leading sociologist of the day) Durkheim also argued that society could not be viewed as a consequence of agreements set up by individuals to promote self-interest. Some form of social solidarity must precede any contractual arrangement. So while Comte and Spencer attempted to ground social phenomena in external conditions, the progressive realization of human potential and the establishment of rational contracts, Durkheim argued that society itself is the primary reality. We do not live in a world composed of abstract actions or bare concrete objects, but in a milieu of things and events embedded in a network of social meaning. The customs, traditions, and expectations implicit in the fabric of social experience determine behavior and give significance to life in a manner that is every bit as real as the physical environment. This web of conventions and rules forms a corpus of social facts. On occasions individuals will be aware of such constraints and will consciously modify their behavior, as in the desire to comply with laws of etiquette and politeness appropriate to certain events. However, at other times we seem to obey social laws unconsciously. An example of this, provided by Sampson (1980a), is the effect of proximity on people of different nationalities during conversation. Close physical proximity is interpreted by many as an intrusion or a threat, whereas in some societies it is accepted as a natural element in personal communication.

Social facts, then, do not exist in the thoughts of individuals but in what Durkheim called the "collective consciousness" of society (Manicas, 1987). This phrase is not meant to conjure up some super-individual mind, but rather to identify the matrix of shared emotions that unite people within a social group. In contemporary society this can be evidenced in the common feelings of a crowd or the sense of patriotism evoked by the national anthem: in short, sentiments that seem to take on a life of their own. In primitive cultures such emotions are generated through religious rituals. For example, Durkheim explains how the totem functions as a means to establish the moral and social norms that bond a tribal community together.

With the diversification of labor, the strict punitive laws that typically protect these religious customs are generalized into more abstract principles like honesty and justice. This set of ideals--historically wrought from our emotional response to social interaction--provides the collective consciousness of contemporary society, which, as Durkheim explains, appears most readily in our response to deviant behavior.

Durkheim's (1912) premise--that to understand an individual's behavior one must first consider the social norms that make it possible--gained popularity upon the publication of his work on suicide.

In an extremely convincing and insightful argument, he showed that despite yearly fluctuations, the variations in suicide rates between several European nations can be interpreted as the result of weakening social bonds within differently formulated cultural norms. Durkheim emphasized the importance of religious and moral commitments within a group and showed empirically that the various levels of "social solidarity" they promoted were directly related to the number of reported suicides. Thus, he maintained, it was not the conscious actions of individual subjects that explained this phenomenon, but the degree of social integration supported by the mores of the culture. With this revelation Durkheim thus anticipates one of the major premises of structuralism, that rules governing social behavior lie beyond the average subject's conscious thought. However, as we will see, according to Lévi-Strauss, Durkheim, like Marx, mistakenly searches for this system of laws in the organization of social institutions rather than the unconscious psychological mechanisms of the structured mind.

Although Saussure (1915/1974) did not represent himself as a disciple of Durkheim, it is clear from a reading of the Course in General Linguistics that he shared the same vision of a new sociological perspective. Just as Durkheim argued that a matrix of rules and norms underlies social behavior, so Saussure believed that linguistic communication was made possible by a system of laws that determines the meaning and structure of all speech.

At the beginning of the 20th century, linguistics was primarily concerned with philology and the study of particular languages. It was Saussure's aim to replace these historical, diachronic inquiries with a more scientific enterprise. Like the new philosophy of society advanced by Durkheim, Saussure attempted to establish linguistics as the study of language viewed as a social fact. The inquiry he originated departed from the traditional cataloging of changes undergone by particular languages in the course of their development and aspired to the more important objective of examining the principles by which language itself functions. Any language, Saussure (1914/1974) argued, could be considered independently of its genesis as a system of rules that establish and maintain the possibility of communication between speakers. Accordingly, the proper task of linguistics was to study this underlying organization synchronically.

To gain access to this corpus of linguistic facts, Saussure made the important theoretical distinction between "langue" and "parole." The latter represents the set of actual utterances made by speakers, whereas the former constitutes the system of rules and principles that govern all linguistic acts. Since these rules are involved in the construction and interpretation of any sentence, Saussure (1915/1974) argued that they must be both antecedent to an agent's speech and shared by every member of the linguistic community.

> Langue is the social side of speech, outside of the individual who can never create or modify it by himself; it exists only by virtue of a sort of contract signed by the members of the community. (p. 14)

Of course, Saussure does not think that each person consciously agrees to abide by the rules of language, any more than Durkheim believes that individuals were aware of a network of social norms. The point Saussure makes is that an aspect of language must exist objectively in the collective consciousness of society, whether or not this is appreciated by individual speakers. Saussure's concept of langue is thus an attempt to separate this essential, social aspect of language from that which is purely particular and contingent upon personal experience. It is not that Saussure thinks synchronic and diachronic studies are independent, for a unified understanding of language and its development has to incorporate scientific as well as historical facts. Rather, like Durkheim, it is simply that Saussure choose to emphasize the priority of the social for the purpose of his inquiry.

No individual can choose to invent words and meanings at will. For Saussure, as for the later Wittgenstein, the acceptance of a socially objective language is a necessary prelude to thought. For whereas particular ideas may be modified, the rules of language are beyond radical revision. They constitute the framework upon which subjects must construct their own knowledge of language. This is not to say that individual words have any privileged status or are immune from change; indeed, Saussure argues, their necessity for thought ultimately rests upon their essential arbitrariness.

The basic unit of language is the sign, which, unlike the symbol, has no implicit or iconic meaning. Every sign expresses a relationship between two components: the signifier that represents the means by which the word is presented as in the spoken sound "alligator," and the signified, the concept to which it refers. Except in the occasional instance of the onomatopoeia, the signifier and the signified are completely unrelated, and the correspondence that exists between words and concepts is purely conventional. To construe it otherwise, according to Saussure, makes no more sense than relating the moves of a chess piece to the material from which it is made. However, far from being problematic, it is just this arbitrary association that protects language and introduces a conservative tendency that guarantees the stability of human affairs. As a self-contained and regulating system, it escapes environmental fluctuations and defines a reality of its own.

According to logical positivists, the meaning of a word depends upon the relationships that can be drawn between its signifier and its referent. In the case of proper names, words like "alligator," "Atlanta," and "apple" do not invoke any concept or idea; they are merely labels associated to particular concrete objects. More general words such as "teacher," which do have conceptual meaning, are considered to be representatives of a class of proper names, in this case the list of all those individuals who are, or have been, teachers. The inevitable intricacies of a theory of meaning based upon such rewriting procedures is evidenced by the complexity of Bertrand Russell's (1905) Theory of Description. It is also a model that, according to Saussure's analysis, misses the essential nature of language. The meaning of the term "teacher," for instance, cannot be caught by any list of names, no matter how extensive. For our understanding of the word depends upon the whole network of assumptions that are carried along with it. Thus, in using "teacher" within a sentence, we implicitly make judgments about a host of associated ideas: educator, lecturer, parent, leader, and so on.

The words in a language gain their sense by virtue of their interrelationships. This network, or matrix of meanings, assigns each term what Saussure calls a "value." For Saussure (1915/1974), unlike the logical positivists, a concept has no explicit content. Its value does not come from within, but from the various systematic differences, or oppositions, that mark it off from other terms in the socially objectified corpus of linguistic relationships. What we understand by the term "teacher" is not constituted by the word itself (indeed, it seems to say very little), but by its selection in relation to its boundary of concepts.

> The concepts are purely differential and defined not by their positive content, but negatively by their relations with the other terms of the system. Their most precise characteristic is in being what the others are not. (p. 114)

As Saussure conceives it, scientific linguistics recognizes language as a formal system of rules that differentiates between signs and proceeds by examining these relationships synchronically in order to chart the network of values that bind the meaning of terms together. Only when this "synchronic solidarity" is appreciated can the meaning of a word be explained. To take a popular example, a Western interpreter may know that Eskimos have many different words for "snow," but until the intricate system of relations that exists between these terms is mapped out in the context of their social life, we will have little understanding of the meaning they hold for the native speaker.

While the autonomy of linguistic systems itself raises important implications for the social sciences, Saussure proposes a more far reaching observation. He argues that other cultural phenomena, in addition to language could also be regarded as conventional systems of communication. Through a similar synchronic analysis, Saussure (1915/1974) believes it is possible to explain phenomena ranging from the many mysterious social rules embodied in religious beliefs, taboos, marriage, and kinship structures, to the explanation of literature and other forms of aesthetic expression.

If Saussure's insight can be credited as providing a prospectus for the structuralist movement, then his method for analyzing language also must be recognized for its part in shaping the techniques of structuralist inquiry. As we have seen, for Saussure language is a network of interrelated values. So in order to describe a particular state of language, one must set out the numerous threads that tie this system of oppositions together. Two modes of relationships can be distinguished. First is what Saussure termed "associative," but which, through Hjelmsev (1961), have become more popularly known as "paradigmatic" rules. These refer to the set of elements that can replace one another in a certain context. On the phonetic level, the phoneme |b| in English is defined in terms of its opposition to other phonemes that can be substituted in cases like |ill|, that is, pill, kill, till, and so forth. In contrast, to repeat, at the level of sentence structure the term "teacher" is paradigmatically related to the set including "lecturer" and "educator."

Second, when we consider the combinatory relationships between terms in the construction of a possible sequence, we embark on a "syntagmatic" analysis of language. Again, on the phonetic level this might involve determining how a particular phoneme can be combined with other syllables. Correspondingly, syntax determines the possibility of jointing terms together within a sentence. For instance, "he awaited" can be accompanied by "his friend," "the end," or even "death itself," but it cannot be combined with "French," "neuron," or "we." Through these twin modes of analysis, Saussure believes that the whole linguistic system can be reduced to a set of synchronic facts. He further postulates a hierarchy of interrelationships between the various levels of language. That is, the set of syntagmatic and paradigmatic structures existing at the phonetic level determines the relationships existing between morphemes, which in turn have implications for syntax and the word structure of language. To take a simple example, the opposition between the sounds |p|, |d|, |b|, and |t| facilitates a similar set of contrasts between the morphemes bin, pin, din, and tin. These then serve to define the meaning and use of words in broader contexts.

This model runs into a problem, however, at the level of sentence structure. For while it was conceivable that society could define a class of distinct morphemes in paradigmatic and syntagmatic relation to one another, it appeared totally implausible for the linguistic community to set out such a system of acceptable sentences. The infinite number of possibilities that could be generated out of a fixed set of morphemes suggested to Saussure that the study of sentence structure was not a part of linguistics, but a matter of parole and a question of individual psychology. Yet when children learn a language, they must accommodate to a set of conventional syntactic forms--in French, for instance, that an adjective follows a noun, whereas in English it precedes it. Such rules, critics point out, must be a part of langue. Saussure's dilemma was thus one of reconciling the creativity of sentence formation with the existence of apparent socially established linguistic norms. Because his conception of paradigmatic and syntagmatic relationships was essentially taxonomic, he saw no way in which a set of conventions could determine the range of possible novel sentences, and he consequently believed syntax to be a feature of parole and the individual's use of signs.

Sampson (1980a) argues that Saussure is forced to accept this alternative, even against the wisdom of his own belief in the priority of langue--as a socially objective fact--simply because he is unable to conceive of any mathematical functions that could generate an infinite set of sentences in accord with the laws of syntax. As we shall see, Chomsky's chief contribution to linguistics lies in his postulation of just such a generative grammar, that is, a finite set of recursive rules that produce an unlimited number of syntactically well formed sentences. This issue is really part of a more fundamental concern often referred to as "the psychological problem of langue" (Sampson, 1980a). On one hand, Saussure, like Durkheim, stresses the objective and socially autonomous character of linguistic rules existing independently of the individual. On the other hand he recognizes that for communication to be possible, each and every speaker must somehow internalize this system. That is, a model of langue must exist in the mind of each person to explain parole. Since many languages appear to have fundamentally different structures, Saussure concludes that the acquisition of langue must depend upon some general cognitive faculty shared by all human beings. However, for Saussure, the process by which individuals unconsciously learn the rules of langue remains a perplexing mystery.

In Chapter 4 we will see that Chomsky answers Saussure's psychological problem and the question of syntax by introducing a distinction between a speaker's linguistic competence and performance (Sampson, 1980a). In many ways this dichotomy mirrors the langue-parole division, especially in its discrimination of the universal and particular aspects of language. According to Chomsky (1964), however, the notion of competence incorporates a concept of system and production that "elevates" it above the "taxonomic" nature of langue established by Saussure.

> Clearly the description of intrinsic competence provided by the grammar is not to be confused with an account of actual performance as de Saussure emphasized with such lucidity. But Saussure regards language as basically a store of signs with their grammatical properties, that is, a store of word-like elements, fixed phrases, and, perhaps, certain limited phrase types. He was thus quite unable to come to grips with the recursive processes underlying sentence formation, and he appears to regard sentence formation as a matter of parole rather than langue, of free and voluntary creation rather than systematic rule. There is no place in his scheme for "rule governed creativity" of the kind involved in the ordinary everyday use of language. (p. 23)

Although Chomsky's inclusion of syntax in the domain of langue and its subsequent re-evaluation as the proper object of linguistic inquiry fulfills Saussure's original insight, his postulation of competence as the seat of syntactical rules departs from the fundamental Saussurian conception of language as a primary social fact. Moreover, since Chomsky believes that linguistic competence is the result of a prefigured brain, he is able to explain each individual's ability to generate an infinite range of novel but syntactically correct sentences. The consequence is a turn from explaining how the individual can obey social conventions unconsciously to the postulation of a subconscious knowledge of grammatical structure. It is a move from linguistics as semiology to linguistics as a branch of psychology and a change of focus from the social to the mental that I will show parallels Lévi-Strauss's criticism of Durkheim.

While Chomsky's mathematical analysis of deep structural rules is clearly more sophisticated than Saussure's notion of paradigmatic and syntagmatic relations, these concepts have been extremely influential within the structuralist movement. More generally, Saussure's idea of langue as a holistic, self-regulating, independent system of signs can be found in the work of almost all structuralist thinkers. In particular, the realization that meaning is generated within language and that signs are based upon an arbitrary set of conventions rather than a system of references undermines the belief in the self as the creator of the world. Saussure thus joins Darwin, Freud, and Einstein in contributing to the de-centering of the human subject that was to be the rally cry of structuralism: "the death of man" (Foucault, 1966).

Roman Jakobson

After Saussure, two independent schools of linguistics emerged. First, in the United States Franz Boas initiated a synchronic study of native American languages (Sampson, 1980a). Troubled by the imminent threat of their extinction, the Descriptivist school attempted to catalog the syntactic structure of these exotic tongues (Sampson, 1980a). Theoretically this evolved into the problem of developing methods for translating the inner organization of radically different languages. American linguistics thus faced the task of establishing scientific procedures that would uncover unfamiliar grammatical structures. In contrast, the European linguists of the Prague school focused their attention on the function of language. Viewing language as a tool, these thinkers related its inner structure to the different uses to which it can be employed. Their aim was to explain how the distinctive features of different languages functioned to achieve the social ends of communication. Unlike the Descriptivists, therefore, the Prague linguists were interested in the meaning rather than the form of language. Yet despite this difference in perspective, there is a sense in which these two schools were brought together through the writings and personal influence of Roman Jakobson.

One of the two leading figures in the Prague School was Nikolai Trubetzroy, a Russian prince exiled in Austria after the revolution of 1917. Rather than simply recording speech structures as Saussure had done, Trubetzroy attempts to set up a typology of phonemes to identify each language as a particular organization taken from the set of possible phonetic arrangements (Sampson, 1980a). This description then enabled Trubetzroy to form functional explanations of the role that phonemes play in language. In particular he aimed to show how phonological oppositions can be used to distinguish, separate, or combine words through the presence or absence of stress in a speech act (Anderson, 1985).

The logical extension of this categorization of sounds is provided by the second and most influential figure of the Prague school, Roman Jakobson. In essence Jakobson attempts to incorporate into Trubetzroy's analysis the idea that the variety of sounds evidenced in human speech were produced by a relatively small number of universal operations within the vocal system. In contrast to Saussure, Jakobson thus rejects the phoneme as the smallest unit of analysis and in its place, postulated the existence of 12 minimal "features," which when combined in various ways would yield the phonemes characteristic of the entire range of human speech.

Clearly Jakobson does not believe that the human vocal system can make only a limited number of noises. Indeed, his analysis of articulatory parameters, such as the position of the tongue in the oral cavity, the location of the soft palate, and the use made in different languages of vocal chord actions, suggests that only a small number of sounds, from an enormous repertoire of possible noises, are ever employed by speakers. In English for instance, sounds are formed by air pumped from the lungs without using any other airstream device. Yet despite the continuous nature of this mechanism, Jakobson (1956) argues that all humans learn to articulate, at most, 12 features by which the phonemes of any language can be formed. This does not mean that sounds cannot be produced by alternative vocal manipulations; a flat sound, for instance, can be made by rounding one's lips or retracting the tongue. The point is that the differential system of sounds employed in language is not determined by the anatomy of the vocal system, but, according to Jakobson, by the psychological structures of the brain. For Jakobson, as for Lévi-Strauss, the network of differences to be found in all forms of communication are the product of the structured mind.

In their earlier studies Trubetzroy and Jakobson had investigated the historical evolution of sound changes within different languages. Later Jakobson, with the technical assistance of his student Morris Halle, attempted to bridge Saussure's synchronic-diachronic dichotomy by examining the ontogenetic development of the phonetic system (Jakobson & Halle, 1956). Accordingly they examined both the child's acquisition of language and the loss of linguistic skills in the psychological disorder of aphasia. This research revealed that the various distinctions employed by all languages are acquired in the same invariant order and that the reverse sequence is observed in aphasia. For example, all children pass through a stage in which the word "can" is pronounced more like "tan," whether they speak English, German, or Japanese. As Jakobson (1962) summarizes, his studies of language development within the individual, as well as culturally as an instance of historical change, reveal a fundamental homology.

> In all parallels between child language (or aphasia) and the languages of the world, what is most conclusive is the identity of the structural laws which determine always and everywhere what does or will exist in the language of the individual and in the language of the society. In other words, the same hierarchy of values always underlies every increase and loss within any given phonological system. (p. 373)

After an initial "tuning-up" period of babbling activity, in which an infant may well voice all the disparate sounds found throughout the various languages of the world, Jakobson claims that children then start to construct the differentiated system of phonemes that characterize their native tongue. The first step in all languages is the discrimination of the loud but compact sound of a vowel from the soft diffuse sound of a consonant. This primary opposition occurs between the optimally open vowel |a| and the optimally closed consonant |p|. Having distinguished sounds on this compact-diffuse axis, the child then differentiates between low and high pitched noises on the grave-acute continuum. This is manifested in the split between the labial sound |p| and the dental |t|. Actually the child also learns to tell the difference between |p| and the nasal phoneme |m|, but since this is not important in the subsequent development of consonant distinctions, Jakobson leaves it out of his phonological triangle (see Figure 3.1). This argument thus explains why "mama" and "papa" sounds are the first to appear in most languages.

The primary triangle |a|-|p|-|t| then is refined as the child learns to discriminate more clearly between the compact sound of vowels and the more diffuse character of consonants. The opposition between |a| and |i| is apprehended and, in most languages is further divided into the |i|-|u| contrast, as the compact sounds of these vowels are gradually separated by their respective high and low pitches. In a similar fashion, the |p|-|t| opposition, once fully realized, provides the basis for the further differentiation between these diffuse consonants and the more compact |k| sound.

In the 20 years since Jakobson conducted his research, many of the details in this argument have been criticized. However, the central claim that there is an invariant sequence of universal stages in the acquisition of speech has been vindicated repeatedly (Anderson, 1985). For Jakobson this hierarchical construction is evidence that the innate binary structures of the mind are being applied to experience. As I will show, Lévi-Strauss adopts exactly the same attitude and also turns to child psychology for support in establishing the existence of the structured mind.

There are several features of Jakobson's theory that establish its importance in the history of the structuralist movement. Most significantly, Jakobson made a fundamental advance on Saussure's notion of language. According to Saussure's original insight, the elements of language at all levels exist in a network of oppositions. In the phonetic domain this translates into a system of mutually exclusive sounds. The phonemes |p| and |k|, for example, are held to be isolated, bounded by a matrix of

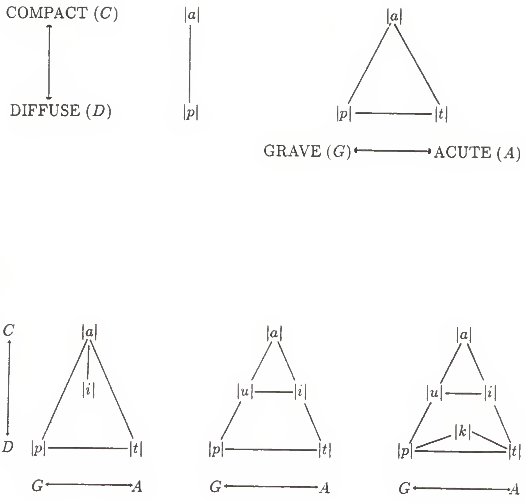


Figure 3.1. Jakobson's Vocalic Triangle (adapted from Jakobson, 1968).

differences. Although Jakobson accepted that |p| and |k| are indeed different sounds, he nonetheless insisted that they share a fundamental identity. In this case, whereas |p| is diffuse and |k| compact, both are grave. Similarly, even though |p| and |t| differ in their respective pitch, each is diffuse. The point to recognize is that the multiplicity of human sounds can be reduced to a more basic set of relations and an apparently complex sea of phenomena explained through a simple underlying structure. The phonemes |p|, |k|, and |t| should no longer be regarded as independent sounds, like solitary musical notes, but rather as orchestrated chords produced by a system of distinctive features. The advantage of this model over Saussure's account is that a single sound no longer needs to be compared to the whole field of phonemes in order to establish its identity. A |p| now can be distinguished from other sounds on the basis, for instance, of its compactness or its non-nasal character.

Since its first publication in 1956, Jakobson's theory of phonetics has been established as a paradigm example of the structuralist method. In the reduction of phenomena to binary oppositions, he provides the blueprint for the organization of surface features in terms of an underlying algebra. In addition, Jakobson also develops a second aspect of Saussure's thought that is to prove equally influential to almost all structuralist writers.

If it was Sassure who envisioned that language could become the model for all semiology, then it was Jakobson who made this program a reality. The distinction that Saussure makes between syntagmatic and associative (paradigmatic) relations is given new life and direction by Jakobson. Each of these functions can be thought of as representing an axis of inquiry. The former is concerned with the combination and contiguity of elements in a string, whereas the latter attends to the selection and substitution of particular terms. Jakobson's contribution is to extend these notions--in accord with Saussure's program--to fields beyond linguistics. In particular, he uses these two axes to study the phenomenon of aphasia and the structure of poetry. This new methodology would be applied by others to a variety of linguistic and non-linguistic sign systems.

In his earlier years, Jakobson had studied Russian folklore, poetry, and literature. From this wealth of knowledge he argues that paradigmatic relations can be compared with the concept of metaphor, which evokes a series of parallel images. In contrast, metonymy expresses a transformation of meaning from one term to another and so becomes an example syntagmatic identities. In the first instance, as with lyrical poetry, the verse turns on the similarity of ideas and suggests that the reader encode the poem with meaning. In contrast, prose works primarily on the contiguity of terms and requires the reader to decode the implicit meaning contained within them. These two fundamental relations appear again in Jakobson's (1956) analysis of speech disorders. Here he identifies two main forms of aphasic impairments, the "similarity disorder" and the "contiguity disorder." The first expresses a weakness in comprehending paradigmatic relations and typically results in the inability to substitute equivalent terms in a sentence. The second set of problems is associated with syntagmatic tasks. Typically patients suffering from aphasia cannot form complete sentences, but rather communicate in truncated, "pulse-like" phrases similar to the wording of a telegram. What Jakobson's inquiries show is that such disabilities are related to the subject's capacity to encode and decode linguistic messages. So, again, as with his analysis of poetry, the two axes of investigation provide a method for uncovering the differential bonds that generate the matrix of meaning.

The explanatory power of this methodology stimulated Jakobson to consider its applications in art criticism, film interpretation, and literature. He also advocates its employment in ethnographic studies of culture and psychoanalytic investigations of the unconscious. If Jakobson did not produce these studies himself, he did provide the impetus for their eventual realization in the work of Lévi-Strauss, Barthes, and Lacan. Indeed, the whole French structuralist movement can be thought of as an application of Jakobson's logic of inquiry to the investigation of different modes of experience.

To summarize, there are at least four ways in which Jakobson set the stage for the emergence of the structuralist movement. First, he had a personal influence on the intellectual development of Lévi-Strauss and Noam Chomsky. After fleeing Prague by way of Sweden, Jakobson like so many European and Jewish intellectuals sought safety from the Nazis in the United States. During the second World War, while professor of general linguistics at the École Libre des Hautes Études in New York, he met Lévi-Strauss. Later as a teacher at Harvard and then as a colleague at Massachusetts Institute of Technology, Jakobson came into contact with Chomsky (Sampson, 1980a). Both thinkers have expressed their debt to Jakobson and clearly, although in different ways, have incorporated his insights into their theories. However, there exists a more subtle personal influence that needs to be recognized. In emigrating to North America, Jakobson effected something of a reconciliation between the two schools of linguistics. This influence can be traced in the development of linguistic theories such as Chomsky's, where the scientific concerns of American linguistics are married to the traditional European interest in the nature of mind.

Second, in his formalization of the idea of binary oppositions and the twin axes of inquiry, Jakobson provides structuralists with the apparatus necessary for the reduction of surface phenomena into logical and mathematical forms. Third, as I have alluded, Jakobson's analysis of phonetics, and to some extent his work on aphasic disorders, provides the structuralist movement with a paradigm example of the kind of investigation it should emulate. Finally, Jakobson, both individualistically and intellectually, acted as the conduit for Saussure's ideas of language and his concept of semiology. It seems fitting, then, that we should also remember Jakobson (1929/1971) as the person who gave this new movement its name.

> Were we to comprise the leading idea of a present-day science in its most various manifestations, we could hardly find a more appropriate designation than structuralism. Any set of phenomena examined by contemporary science is treated not as a mechanical agglomeration but as a structural whole, and the basic task is to reveal the inner, whether static or developmental, laws of this system. What appears to be the focus of scientific preoccupations is no longer the outer stimulus, but the internal premises of the development; now the mechanical conception of processes yields to the question of their functions. (p. 711)

Claude Lévi-Strauss

The term "structuralism" has become, for many, a synonym for the works of Claude Lévi-Strauss. As the central figure in this movement, the authority of his writings have stimulated and sustained its popularity in French intellectual circles. Above all, Lévi-Strauss's insights and daring hypotheses have impressed a generation of social scientists and held out the promise of a scientific investigation of culture. Like many of the continental philosophers who preceded him, his ultimate goal is to understand the human mind. However, unlike this tradition, his method is not to explore the reality of the Cartesian ego. For Lévi-Strauss there is no transcendental subject, and its postulation has only resulted in three hundred years of philosophical confusion, evidenced by the phenomenology and the existentialism of his arch rival, Jean-Paul Sartre. In its place Lévi-Strauss proposes to investigate a series of fundamental dichotomies, including the distinctions between reason and perception, nature and culture, and the individual and society. His point is that the diversity of human behavior is the superficial face of a deeper structured reality. The task before the anthropologist thus is to conduct a scientific inquiry into the system of psychological laws that support the "grammar" of social action. While different societies have evolved a plethora of unique customs and exotic rites, these practices are to be seen as nothing more than particular manifestations of a common intellectual capacity. Unlike Sartre and the influential French sociologist Levy-Bruhl, Lévi-Strauss thus believes that there is no difference between the minds of civilized subjects and their primitive counterparts. Accordingly, since modern society is so homogeneous and complex, anthropological investigations of natural cultures provide a unique opportunity to explore human nature in its most accessible form. It is by studying how natives resolve such dichotomies, the essential problems of life, in their religious beliefs, myths, social organizations, and kinship practices that the fundamental nature of the mind can be uncovered.

In many respects Lévi-Strauss's theory marks a reunification of Saussure's linguistic insights with the French sociological tradition established by Durkheim. As we will see, Lévi-Strauss employs both Saussure's concept of langue and Jakobson's method of binary analysis (along with the paradigmatic and syntagmatic axes of inquiry) to investigate the origin and structure of social order that Durkheim had addressed in his Elementary Forms of Religious Life (1915). However, it was to be a combination of Lévi-Strauss's own anthropological and intellectual experiences that would breathe direction and drive into this project.

In the remainder of this chapter I will discuss Lévi-Strauss's structuralist science of mind in some detail. My exposition is divided into five parts. First I will present the historical and intellectual context in which Lévi-Stauss's theory is set, in order to spell out the theoretical concerns his arguments address. Then I will explain Lévi-Strauss's scientific methodology and the criteria that govern the focus of his inquiries. In the third part I will review the three main phases of his life's work: his study of kinship structures, primitive thought, and myth. Next, I will compare Lévi-Strauss's new psychology with Kant's thesis of the structured mind. Finally I will present my own general criticisms of the structuralist project. Throughout these various arguments my aim will be to undermine all efforts to separate the form of thought from the context of the activity in which it is found. As Hegel criticized Kant for his a priori deduction of the categories, so I will argue against Lévi-Strauss that the structures of mind are defined by the purposive character of social life.

Structuralism, Existentialism, and the Subject

In his autobiographical novel, Tristes Tropiques, Lévi-Strauss (1955) claims to have had three intellectual mistresses: the study of geology, the writings of Freud, and the sociology of Marx. (To this list one also could add his passion for music and his desire to emulate the formalized arguments of mathematics, since these two themes continually direct his analysis of culture). For Lévi-Strauss, each member of this trio of sciences suggests a reduction of surface phenomena to an underlying, unobserved, yet ontologically real structured reality. In each of these sciences a profusion of seemingly unrelated and confused information is fitted precisely into a system of rules that explains the ostensibly random state of affairs as a necessary outcome of some inner mechanism.

Lévi-Strauss's first love was geology, which he always maintained constitutes a paradigm example of knowledge. Since childhood he was impressed by the way geologists piece together information from the landscape to form an historical record of an area. Apparent disorders or juxtapositions in the vegetation of a region or the anomalous occurrence of fossils from different eras in a single rock strata enable scientists to infer a record of geological change. When aware of this underlying matrix, the multiplicity and confusion of nature falls into place. It was as if space and time were suddenly frozen in a sea of continuous facts in order to present an environment full of riddles and contradictions. The geologist thus has the creative and, for Lévi-Strauss, aesthetically rewarding task of unraveling these strands in order to assemble the true reality that brings order to this wealth of perplexing and obtuse data.

In a similar manner, the Freudian psychoanalyst starts with the jumbled and seemingly impenetrable phenomena of human behavior and reaches back to construct a system that can explain the whole psychic universe. By analyzing dreams and slips of the tongue, Freud attempted to create a model of the unconscious mind that would support the tangled confusions of conscious thought and action. As with geology, which seeks to bring order to the vast atemporal mass of physical data, the analysis of the unconscious also attempts to fashion eternal truths and laws that can systemize the enormous variety of human behavior. The order that these two sciences brought to the individual and physical worlds was complemented in the mind of the young Lévi-Strauss (1955) by Marx's analysis of society.

> Marxism seemed to me to proceed in the same way as geology and psychoanalysis. . . . All three showed that understanding consists in the reduction of one type of reality to another; that true reality is never the most obvious of realities. . . . In all these cases the problem is the same: the relation . . . between reason and sense-perception. (p. 61)

While Lévi-Strauss endorses Marx's insight that consciousness is determined by an inner organization, he refuses to equate this with either the institutions and cultural morphology of society or the dynamics of economic production. Lévi-Strauss is convinced that the basic structures of the mind do not evolve. So, in contrast to Durkheim and Marx who sought to explain mental phenomena in terms of social organization, Lévi-Strauss argues that social structures are the product of a fixed intellect. That is, the same set of biologically inherited capacities are shared by all human beings, whether in a primitive state of economic survival or in the consumer oriented society of the 20th century.

Before discussing the specifics of Lévi-Strauss's theory of mind, it will be useful to consider the context in which his ideas were formulated. Indeed, a brief synopsis of the central problems facing French thought during the first half of this century helps explain the emergence of the two main philosophical movements of the second half, namely, existentialism and structuralism. When we examine the roots of these theories in the social and intellectual problems addressed by Sartre and Lévi-Strauss, not only does the source of their rival and opposing claims come into focus, but also there is seen a sense in which each approach offers a complementary response to the same set of issues.

At the turn of the century France was fired by a vision of a new republic. In an attempt to rebuild the country after the Franco-Prussian war, the traditional authority of the church and the power of the conservative elite were rejected by the intelligentsia in favor of a secular conception of life based upon reason. Durkheim's theory of the collective consciousness was adopted as a template for this rational society, which was to be achieved through the moral education of French youth. As Clarke (1981) sums up, the prevailing social philosophy was

> collectivist, asserting the existence of society as an entity distinct from, and standing over, the individual. It is sociologistic, for the reason and morality that distinguish humans from animals derive not from the individual but from society. It is rationalistic, for society is a purely rational sphere, affectivity being a quality of the biological individual that society displaces. It is secular, for religion is the product of an irrational affective reaction to society that is progressively displaced by the advance of society and the concomitant progress of reason. Finally it is positivistic, for social facts are external facts, constraining on the individual, and so amenable to study by the methods of positive science. (p. 11)

During the 1920s, French thought, like the country itself, was bankrupt, its youth and spirit devastated by the economic aftermath of war. To a new generation of intellectuals the traditional beliefs in the progress of history and the moral authority of society seemed both irrational and idealistic. Reflecting on the nationalism that had destroyed Europe, philosophers like Sartre and Merleau-Ponty seek to establish the moral primacy of the individual above the demands of the state. Similarly, Lévi-Strauss campaigns against the implicit racism of Western monoculture and attempts to replace Durkheim's collective consciousness with a subjectivity based morality. However, while both Lévi-Strauss and Sartre turn toward the individual, neither is willing to accept the Anglo-Saxon concept of the "empirical self." Each seeks a "deeper" more essential conception of the subject. Lévi-Strauss, employing gestalt psychology, argues that the rules that Durkheim found within society are actually a feature of each individual's cognitive unconscious. On this view, social order, indeed the very origin of culture, is a product of our innate mental programming. Human conduct is not to be explained through an analysis of society but through a scientific investigation of the structured mind. In contrast, Sartre

(1943/1953), following Husserl and Heidegger, remains within the Cartesian tradition by proposing a philosophical introspection of consciousness in order to reveal our essential being within the pure thinking ego.

The famous debate between Lévi-Strauss and Sartre springs from these two radically different approaches to the same fundamental problem (Harland, 1983). For, in contrast to Lévi-Strauss's faith in science and the Kantian view of a fixed mind, Sartre forges a somewhat contradictory union between Hegel and Descartes to produce a theory in which the individual ego is responsible for the historical development of its own consciousness. While other structuralists may not endorse Lévi-Strauss's model of innately determined categories, preferring to accept the social basis of thought, they nonetheless remain fundamentally opposed to phenomenology and its commitment to self-conscious reason (Harland, 1983). For example, expanding upon Saussure's concept of langue, Foucault (1966) argues that meaning is neither derived from the external world--as empiricists would have it--nor the product of a creative Cartesian ego, but is a consequence of the linguistic system we employ. The subject for Foucault is an empirical construct, which like any other construct, depends upon our use of language.

It might be argued that existentialists recognize the tendency to hide in the anonymous structures of society. Indeed in many of his works Sartre considers how individuals deny their own "authenticity" and take on the identity of conventional social roles, uncritically accepting the images implicitly contained in language. But this is a life lived in "bad faith." For however strongly such ties may bond us, Sartre argues it is always possible to break free and view an absurd vacuous world devoid of any social sense. In the emptiness of the self, this experience reveals that the subject can transcend its socially constructed existence and achieve a level of consciousness that permits self-directed action. The natural world in which we live is wholly determined, but human beings through the capacity to relinquish their fixed social character have the ability to escape and exist as "nothing." Yet freedom resides in the indeterminateness of being, for in this state individuals can choose, independently of natural laws, the course of their own actions. In fact, for Sartre, the realization of our own "thing-like" nature, while being a distressing and nauseating experience, is accompanied by a moral imperative.

Those who exist in between the fluidity of freedom and the brute facts of nature exhibit a slimy "viscous" character that betrays the implicit evil of their lives.

The appeal of existentialism lies in part with the explanation it offers for the madness that gripped Europe during the first half of this century. The irresistible currents that swept nations into war appeared both senseless and beyond conscious control, as if individuals could have no say in their own destiny. The horror and turmoil that ensued furthered the realization that the subject had denied its own authenticity and had shrunk into the mere appearance of being, an object to be manipulated for the ends of others without any sense of personal integrity. The intense personal disgust that many felt for these events could thus find an intellectual satisfaction in the emotional and moral imperatives of existentialism.

The structuralist, however, denies the individual even this escape from the events of the real world. There is no deeper personal reality for the subject to retreat into. Like Kant, who dismissed the primacy of nature over mind by asserting that the world appears to us through the categories, structuralism maintains that both the "inner" and "outer" faces of experience must conform to the linguistic and cultural sign. In the end, it is argued, there is no autonomy of the intellect, and phenomenologists must recognize that they can get no closer to the nature of mind through introspection than anthropologists can by examining the external manifestations of thought (Pettit, 1975).

Lévi-Strauss's belief in psychological universals and the unreality of the ego therefore stands in stark opposition to Sartre's faith in the political and historical development of the individual consciousness. Consequently, the confrontation that ensued between these two leading figures was not simply a power struggle between French intellectuals, although at times the polemics were scathing and contemptuous. At stake was the very legitimacy of the humanist viewpoint, which for Sarte underlies the reality of the subjective consciousness. According to Sarte (1943/1953), civilized men and women have, through historical, economic, and political development, established the capacity for free-will, creativity, and self-determination. The primitive natives of exotic societies who are frozen in a timeless flux remain in a state of simple harmony with nature. Just as Rousseau (1755/1964) had argued two centuries earlier, Sartre believed them to be incapable of rational thought or intellectual processes. As a young anthropologist visiting the jungles of Brazil, Lévi-Strauss thought he had discovered Rousseau's image of life in a pristine state when he found a long-isolated tribe called the Nambikwara. However, he soon realized that the romantic simplicity he had imagined was an illusion. For beneath their apparently bucolic existence, these so-called primitives share exactly the same petty rivalries, humor, needs, and political desires that are typical of life in modern society. The human mind, Lévi-Strauss recognized, exhibits the same universal structures. It is not the differences in culture or custom that are significant, however extreme these may be, but the common humanity that underlies the lives of both savage and savant.

The battle of words raged. Sartre argued that Lévi-Strauss's view of the individual robbed men and women of their basic dignity and reduced the subject to the status of an "ant." Lévi-Strauss claims that by placing the thinking ego at the center of experience, Sartre had developed an indulgent and petty philosophy. Gaining the upper hand, to judge by popular opinion, he further criticizes existentialism for its closed-minded attitude and resolves to replace its introspective musings with a scientific study of mind (Clarke, 1981). In a caustic and thinly veiled criticism of Sartre, Lévi-Strauss (1971) voices his objection to this movement.

> Existentialism--a self-admiring activity which allows contemporary man, rather gullibly, to commune with himself in ecstatic contemplation of his own being--cuts itself off from scientific knowledge which it despises, as well as from human reality, whose historical perspectives and anthropological dimensions it disregards in order to arrange a closed and private little world for itself, an ideological Cafe du Commerce where, within the four walls of a human condition cut down to fit a particular society, the habitués spend their days rehashing problems of local interest, beyond which they cannot see because of the fog created by their clouds of dialectical smoke. (p. 640)

Lévi-Strauss thus regards existentialism as a clear case of modern egocentrism. By placing the subject first, this humanistic attitude has generated a self-centeredness which, in Lévi-Strauss's (1971) opinion, is responsible for many of the evils of contemporary life.

> In a century when man is bent on the destruction of innumerable forms of life . . . a properly appointed humanism cannot begin of its own accord but must place the world before life, life before man, and the respect of others before self-interest. (p. 422)

One corollary of Lévi-Strauss's (1966) attack on Sartre's view of the development of consciousness is that exactly the same universal structures of mind ought to be observable in both the diachronic unfolding of society through history and the synchronic analysis of different cultures existing around the world.

> The anthropologist respects history, but he does not accord it a special value. He conceives it as a study complementary to his own; one of them unfurls the range of human societies in time, the other in space. And the difference is even less great than it might seem, since the historian strives to reconstruct the picture of vanished societies as they were at the points which for them correspond to the present, while the ethnographer does his best to reconstruct the historical stages which temporarily preceded their existing form. (p. 256)

One thing should be clear, Lévi-Strauss like Chomsky has little respect for empiricism and what they both see as the "blind collection of facts." Early anthropologists who merely reported the strange and exotic practices of other cultures only served to propagate the naive conception that native men and women were simply childish. By concentrating on superficial differences, their inquiries focused on the content rather than the form of social life. As such they committed a fundamental error, the study of phenomena as an end in itself. It is not that Lévi-Strauss dismisses the importance of fieldwork, as his massive four volume analysis of American Indian myths demonstrates. The point to recognize is that each native culture is seen as only one in an infinite set of possible social orders that can be generated by the innate psychological structures of the human mind. For ethnographers to identify such conceptual schemes, a vast inventory of cultural practices and beliefs must be accumulated.

By searching for structural isomorphisms in this corpus of myths, taboos, kinship laws, and social organizations, the workings of the mind will come into focus. Further, by equating these psychological structures with those existing in the external world, Lévi-Strauss (1971) proposes a new kind of realism. The mind, he argues, is just an object among other objects, so by investigating its properties scientifically, rather than philosophically as Kant did, he claims to complete Rousseau's dream and return human beings to nature.

One of the central themes in structuralist thought is thus the "death of the subject." As Marx and Freud demonstrated, scientific study reveals that the personal domain of thought is a false consciousness, continually fooled by delusions of its own authority. For Lévi-Strauss (1971), the mind is an element of nature with objective structures that lie beyond, or rather beneath, introspective reason. The only way to discover its form is to conduct an ethnographic study of social organizations from which the universal rules of thought can be inferred. The paradigm example of such psychological mechanisms can be seen in each individual's unconscious knowledge of language. (As Chomsky argues, all human beings are able to construct grammatically correct sentences even though the vast majority have no formal knowledge of syntax.) It is thus language--with its promise to reveal the universal categories of mind--that has been employed by structuralists as a key to decipher the immense catalog of human behavior. In particular, Lévi-Strauss believed that by combining Saussure's concept of langue with Jakobson's notion of binary oppositions, all social phenomena could be reduced to systems of oppositions generated by the essential mechanisms of thought.

To recall, Saussure (1916/1974) argues that signs are arbitrary and that it is the relationship between terms that constitute the proper object of linguistic inquiry. Further, Jakobson (1956) demonstrated that a small number of psychologically innate phonological units can generate the vast multiplicity of sounds found within all languages. It just remained for Lévi-Strauss to unite these conclusions by identifying social phenomena as elements in a system of signs formed out of binary oppositions. This synthesis of organization and construction is the central tenet of Lévi-Strauss's scientific method.

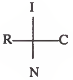
Binary Analysis and the Nature Culture Dichotomy

Before exploring Lévi-Strauss's quest for mind through his investigation of primitive cultures, I first will describe his method of analysis and discuss the choice of the subject matter for his inquiries. Throughout his various ethnographic studies, Lévi-Strauss (1967b) has consistently attempted to explain cultural phenomena by establishing them as systems of organization generated by psychological mechanisms of binary opposition. In his description of native myths, for instance, he claims to be guided by the following formula, the so called "law of symmetric inversion."

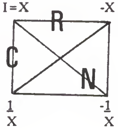
$F_x(a):F_y(b)::F_x(b):F_{1/a}(y)$ (p. 228)

While strictly speaking this statement is mathematically meaningless--confusing variables and constants, functions and their inverses--it is fairly clear from the examples that Lévi-Strauss provides that he is proposing to reduce many myths to the schema shown in Figure 3.2. Borrowing Lévi-Strauss's notation, the variable x may be used to represent a theme within a myth that is related to the other components of the story through the operations of "reciprocity," "correlativity," and "negation." The semantic field that this network of "mythemes" yields can be modeled by the Klein four group, a mathematical structure generated by the Cartesian product of two binary oppositions (shown in Figure 3.2).

As we will see in Chapter 5, this Boolean group also is used by Piaget as a mathematical expression of a system in a state of equilibrium. Although Lévi-Strauss does not derive this structure formally and is somewhat vague about its application, he refers to it on numerous occasions (e.g., 1968, pp. 356-358, 382, 420). For both authors it provides a means of modelling the set of relationships that exist between the parts and the whole within an organized system.



I:N::R:C



	I	N	R	C
I	I	N	R	C
N	N	I	C	R
R	R	R	I	N
C	C	C	N	I

Figure 3.2. The Klein Four Group

Piaget uses the Klein four group to describe the cognitive structures that underlie intelligent behavior, whereas Lévi-Strauss--drawing upon Gestalt psychology--sees it as a method of representing the network of rules that support social conventions. In one of his clearest examples, Lévi-Strauss (1968/1978) explains the internal organization of a North American myth.

> The possession of a scalp ensures success in war, while the ingestion of female scurf leads to lack of success in hunting. According to M493b, the non-ingestion of the liver is the pre-condition of the husband's success in hunting. Lastly, menstrual blood causes lack of success in fighting; the Plains Indians would remove the sacred bundles used for military rites from a tent when there was a menstruant woman. We thus arrive at a kind of Klein group, if we give the values x, -x, 1/x, -1/x to the scalp, the dandruff, the liver and the menstrual blood, respectively. (p. 403)

It is not that all cultural phenomena can be reduced to Klein groups; rather, this system, like many other mathematical structures, is the product of binary oppositions and thus according to Lévi-Strauss is the kind of organization that can be generated by the innate mechanisms of the mind.

Lévi-Strauss's analysis of culture can be read at a variety of levels. For anthropologists it provides a highly abstract description of human behavior, while for philosophers and psychologists it is an insight into the nature of the mind. However, in a fundamental sense it also addresses one of the central questions in French intellectual thought since the time of Rousseau: How is society possible? This problem of explaining the passage of human beings from the state of nature to that of culture occupies center stage throughout Lévi-Strauss's extensive oeuvre.

Durkheim equates nature with our biological drives and irrational impulses and attempts to explain how rules derive from a collective emotional experience impose order on social relations and ultimately lead to the development of rational thought. Reason is thus seen to be the product of culture. In contrast, Lévi-Strauss seeks to turn this argument on its head. According to his theory, society is possible because of the innate--rational--structures of the individual mind. Thus our biological nature working through the cognitive unconscious generates culture.

While the structured mind may formulate a vast number of arbitrary practices, there are certain fundamental problems that it must address if society is to be possible. For example are the laws concerning the distribution of valued goods. In complex societies these rules are the historical foundation upon which all other cultural practices are ultimately based, whereas in primitive communities they openly define the whole system of life. The most obvious examples of such codes are the laws concerning cooking practices and marriage. Since such rules are both universal and arbitrary, they sit at the very interface of culture and nature, providing the cement that bonds individuals within a social group. It is by searching for the structure implicit within these rules of organization that Lévi-Strauss (1949/1969) hopes to determine the logic of thought and prove that culture is generated by the inherited mechanisms of the structured mind.

> The interrelationship between nature and culture does not favor culture to the extent of [culture] being hierarchically superimposed on nature and irreducible to it. Rather, [culture] takes the form of a . . . duplication of mechanisms already in existence [in nature] a duplication, moreover, permitted by the emergence of certain cerebral structures which themselves belong to nature. (p. xxix)

In sum, Lévi-Strauss follows Jakobson in equating the institutions, customs, and myths of a culture with langue: systems of communication generated by the binary structure of the unconscious mind. In primitive societies where the rules that create a community are the most accessible, the mind can be observed in its most perspicasious form, organizing the world by establishing oppositions and associations, that is, constructing culture out of nature through the operations of metaphor and metonymy. This, for Lévi-Strauss, is the "science of the concrete." In order to illustrate how this method of analysis is employed, I will consider one of Lévi-Strauss's most famous and surprising examples, in which he attempts to demonstrate how human beings distinguish themselves from nature through the establishment of cooking rituals.

Lévi-Strauss has cataloged many native myths that attempt to explain the origin of society through the discovery of fire and the development of culinary practices. Such stories typically justify the arbitrary rules governing food preparation by constructing analogical explanations out of the features that comprise the primitive's natural environment. Such rules, which are established to control the distribution of food on various occasions, must be presented in some intellectually satisfying form if they are to be learned and accepted by the community. Typically, then, myths frame tales out of the plants and animals found within experience in order to explain social customs. However, what matters for Lévi-Strauss is not the content of these stories, but the way in which the structured mind generates cultural meaning out of natural objects.

Using Jakobson's vocalic triangle, Lévi-Strauss (1968) proposes the "culinary triangle" (illustrated in Figure 3.3) in which different categories of food are related by the set of binary oppositions culture/nature and normal/transformed. Many myths recognize the existence of oppositions among the raw unprocessed foodstuffs of nature (whether animal or vegetable), the inedible rotten remains of decayed food, and that which has been culturally transformed through the process of cooking. Some myths, for example, set men and women against the carnivorous jaguar that eats raw meat, while others are related to scavengers that live on rotten or decayed food. This triad establishes a set of structural relationships that parallel attitudes towards certain cooking practices. Of course, the homologue is not incidental, for in preparing and cooking food, human beings implicitly make a statement about themselves, their culture, and its relation to nature. The different processes employed in cooking thus provide a system of meaning through which to communicate this understanding. Given that human beings, unlike other animals, have no basic drive that will distinguish what is and what is not edible, it can only be the conventions of society that determine what may be eaten and when it is appropriate to do so. Since these rules relate to social occasions, there must be some relationship between the kind of food eaten and the event itself, a claim that Lévi-Strauss supports with copious examples of how people throughout the world, despite their radically distinct diets, afford each of these cooking processes a similar degree of social prestige.

Why should the roast be the center of a festive occasion? Why do we tend to feed boiled foods to children and the infirm? Why should only women be allowed to boil foods in many native societies, whereas men are placed in charge of roasting? According to Lévi-Strauss, each of these cooking techniques is suggestive of certain images that serve to define a field of meaning. In this context myths, rituals, and customs emerge in order that people can communicate some of the basic questions of their existence. The most fundamental relationship, both historically and conceptually, is the opposition between the boiled and the roasted. Since in the process of roasting the meat comes into direct contact with the flame without, that is, the mediation of any cultural artifacts, it seems to rest on the side of nature. In contrast, boiling employs both a receptacle and the agency of water in the transformation

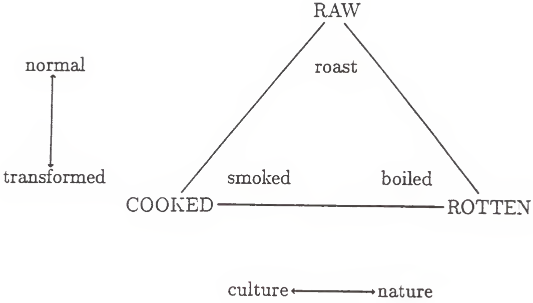


Figure 3.3. The Culinary Triangle (adapted from Lévi-Strauss, 1968)

of food and therefore implies culture. Further, in both the native and modern cultures, roasted meat often is associated with raw meat, partly because of its red color and partly because of its tendency to be undercooked. Similarly, boiling appears to break down food and so connotes for Lévi-Strauss the image of rotten or decayed material. Thus, whereas roasting employs a natural means and results in natural ends, boiling is a cultural process that achieves a natural result.

The third mode of cooking Lévi-Strauss identifies is the process of smoking. Like roasting, this technique uses a natural cooking agent. Hot air is driven through a barbecue frame to heat the meat more slowly, but more thoroughly than during roasting. Once again a natural source is employed, but this time the result is a cultural product, for smoked meat, Lévi-Strauss argues, is the one that best represents the "abstract category of the cooked" (Leach, 1970). A further contrast between the boiled and the smoked lies in the observation that the utensils employed have different cultural significance.

Many myths suggest that it is important to maintain boiled food within a sealed pot in case the spirit of the animal escapes and warns the surrounding game to leave the area. Likewise, other myths demand that the barbecue should be destroyed immediately after use so that it cannot be used by animals seeking revenge on the hunter. More commonly this attitude is manifested in the social desire to preserve, clean, and polish the pots and pans used in cooking, as if these are prized cultural possessions. The barbecue, however, is usually destroyed after use. Thus, according to Lévi-Strauss, there exists a kind of inverse law; for a long-lasting result, the means must be temporary, whereas the task of maintaining the cooking utensils is done at the expense of the food.

As I pointed out earlier, these different modes of cooking are suggestive of the states of raw, cooked, and rotten, as shown in Figure 3.3. The work of the structured mind can be observed in the following set of relationships. The roast, which is both raw and cooked, embodies the ambiguities of culture and nature implicitly. Smoking and boiling do so explicitly. Boiled food, by virtue of its resemblance to the rotten, conjures up nature metaphorically, whereas steaming apparently uses the category of metonymy by suggesting that the destruction of the barbecue frame results in a transfiguration from nature to culture. The whole matrix of concrete thought is summed up by Lévi-Strauss (1968) in the following passage.

> The smoked and the boiled stand in opposition to each other in respect to the element interposed between the heat and the food: in the one instance it is air, in the other water. The smoked and the roast are in opposition through the greater or lesser volume of air involved; the roast and the boiled through the presence or absence of water. The dividing line between nature and culture, which can according to one's preference, be drawn parallel either to the axis of air or that of water, places the roast and the smoked on the side of nature and the boiled on the side of culture, in respect to the means used, and the smoked on the side of culture and the roast and boiled on the side of nature, in respect to the results obtained. (p. 490)

Of course, an analysis of cultural forms in terms of binary oppositions can yield more complicated mathematical structures than Jakobson's triangular model. For instance, in order to incorporate oil as a cooking agent and include the processes of frying and grilling, Lévi-Strauss proposes extending the culinary triangle into a tetrahedron!

While the reader may accept that Lévi-Strauss identified some interesting and important relationships in this analysis, one is also left with the impression of being the victim, as Leach (1970) puts it, of a "verbal sleight of hand." Indeed, according to Leach, for some Anglo-Saxon critics such arguments only seem to make sense when viewed as a kind of intellectual word game played by French intellectuals. Such attitudes are unfortunate, especially when viewed in the context of Lévi-Strauss's extensive analysis of American Indian myths. However, they do direct our attention to a legitimate concern with Lévi-Strauss's methodology. Namely, are the structural models devised by the anthropologist imposed upon the phenomena, or do they reveal the actual workings of the unconscious mind? As I will show, this problem of the psychological reality of structure repeats itself throughout Lévi-Strauss's work, raising the issue of whether he has actually produced a science of the mind or merely an alchemy of symbols. I will return to this question in my concluding remarks.

My intention in running through this argument is not to offer a critical appraisal of Lévi-Strauss's analysis of myths, but merely to present a typical example of the methodology and subject matter of his inquiries. I will now turn to the main body of Lévi-Strauss's work, which falls into three broad phases within his life-long search for the structured mind: the study of kinship systems, the logic of primitive thought, and the interpretation of myths.

Kinship Structures

The natural context for Lévi-Strauss to employ his method of binary analysis was on French anthropology's most celebrated discovery, the concept of exchange. In Structural Analysis in Linguistics and Anthropology (1967b), Lévi-Strauss seeks to establish the heritage of this tradition by setting himself up as the "inconsistent disciple" of Durkheim and Marcel Mauss (Durkheim's nephew and intellectual successor). In his major work, The Elementary Forms of Religious Life (1915), Durkheim asserts that religion begins with the distinction between the sacred and the profane. The object of faith is not important, the only significant fact is that it establishes a division between the world in which we live and a world apart. Accordingly, totemism can be seen as the first form of religious belief. Yet, the division it establishes between the natural and the spiritual is, for Durkheim, only the superficial face of a deeper separation. The creation of individual clans through the worship and reverence of particular plants and animals serves a more important social function than the meeting of religious needs. It distinguishes the followers of the totem from the rest of the tribe. Ultimately, totemism is not a matter of a subject's relation to God, or to the natural world, but the standing of a person with respect to others. According to Durkheim, when natives worship a primitive idol, they are simply submitting themselves to a social principle through which individuals are bonded into a clan. The emotional solidarity generated by the totem provides the basis for the social and moral order that is expressed, in the first instance, through the laws surrounding incest and kinship practices.

In an attempt to retain the force of this argument while debunking what he believed to be its unnecessary metaphysical entanglement with the notion of a socially objective consciousness, Mauss (1925/1967) proposes that the laws of bonding are a product of the individual's unconscious mind. Like Durkheim, Mauss accepts that human beings cannot exist in isolation. Only through our collective efforts and the construction of society is life possible. But how is such an association established? One solution might be to use coercion and force, another to seek the help of others through the bartering of goods. Yet, in both cases the contracts made would be unreliable and unproductive, especially in a time of need. Rather, Mauss argues that it is the giving of gifts that forms the basis of society by uniting people through ties of reciprocal obligation. Indeed, the apparently universal phenomenon of gift giving--often associated with ritualistic ceremonies--is well documented by anthropologists (Lévi-Strauss 1949/1963, p. 52-63). Lévi-Strauss (1955) himself claims to have witnessed this practice during his travels in Brazil, when he observed the establishment of trading relations between two rival but ecologically interdependent tribes.

While Mauss replaced Durkheim's collective consciousness with a psychological disposition to reciprocate the deeds of others, for Lévi-Strauss this still rested society on an irrational footing. Mauss, he argues, believes that it is the gift itself that generates the network of obligation, thus basing the possibility of culture on a capricious act. Completing the swing from Durkheim, Lévi-Strauss accordingly establishes the "principle of reciprocity" as an innate feature of the structured mind. This biologically evolved mechanism of the cognitive unconscious makes exchange possible and thus, as with cooking practices, defines a set of universal laws that form the basis of a culture.

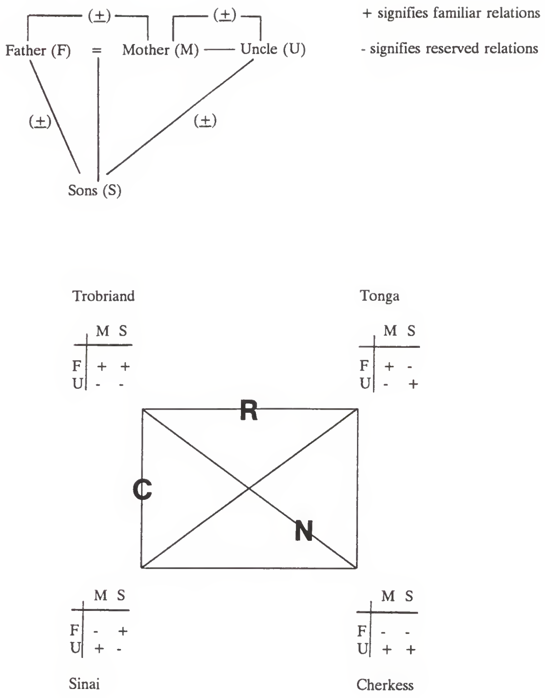
Lévi-Strauss's first major work--and doctoral dissertation--The Elementary Structures of Kinship (1949/1963) is an attempt to apply the principle of reciprocity to the study of marriage as a form of exchange. Following Durkheim, he argues that the rules that underlie primitive kinship systems are not constructed to preserve the integrity of blood ties. So, unlike anthropologists such as Radcliffe-Brown, who sought a functionalist explanation for the existence of rules like the avunculate relation and the incest taboo (linking such laws to the social good), Lévi-Strauss set out to show how such practices are a consequence of the individual idiolect (Clarke, 1983). Expanding on Mauss's insight, he explains that the greatest gift any family can provide is to allow its women to marry outside of its circle. The resulting network of interrelated family relationships this practice weaves establishes a matrix of obligations and responsibilities that holds society together. The totemic system creates separate clans that, although arbitrary in their genesis, nonetheless are essential to society, for it is in the separation of these groups that the conditions for social exchange are created. The incest taboo is therefore a negative face to the positive rules of kinship. The structured mind establishes such relations to control natural instincts with laws that permit the formation of cultural life. Comparing such systems with Saussure's concept of langue, Lévi-Strauss (1967b) describes how these practices parallel the sending of messages in linguistic communication.

> In the study of kinship problems (and no doubt the study of other problems as well), the anthropologist finds himself in a situation which formally resembles that of the structural linguist. Like phonemes, kinship terms are elements of meaning; like phonemes, they acquire meaning only if they are integrated into systems. "Kinship systems" like "phonemic systems" are built by the mind on the level of the unconscious thought. Finally, the recurrence of kinship patterns, marriage rules, similar prescribed attitudes between certain types of relatives, and so forth, in scattered regions of the globe and in fundamentally different societies, leads us to believe that, in the case of kinship as well as linguistics, the observable phenomena result from the action of laws which are general but implicit. . . . Although they belong to another order of reality, kinship phenomena are of the same type as linguistic phenomena. (p. 34)

Lévi-Strauss's central concern is to reject all attempts to explain marriage laws through blood ties. For while such relationships clearly play an integral part in all kinship systems, experience also shows that legal and moral obligations have an equally important role. So in contrast to Radcliffe-Brown, who based his view of social organization on the biological family, Lévi-Strauss seeks to prove that such roles are not facts of descent but relationships generated by the grammar of thought (Clarke, 1983). In one of his most celebrated examples Lévi-Strauss (1976) claims to have uncovered the logic of the avunculate. This relationship, he argues is a property of the matrix of positive and negative ties that define the basic family unit. This network of friendly and reserved relationships can be reduced to what Lévi-Strauss (1976) defines as the "atom of kinship," a structure revealing the tensions and affinities between siblings, parents, and children. While this system of family liaisons may vary from culture to culture, Lévi-Strauss has identified just four empirical variants throughout the world, which interestingly enough can be considered as transformations within a Klein group (shown in Figure 3.4). For Lévi-Strauss, such isomorphisms support his claim that a universal grammar orders the surface elements of the world in the same systematic fashion.

The avunculate is not just a relationship between the uncle and nephew of a family, but a feature of the whole system that expresses all the kinship ties uniting a family. As such, it may be considered as a corollary of the incest taboo. Put technically, Lévi-Strauss (1976) considers the avunculate to be the invariant relation that uncle and nephew are to brother and sister as father and son are to husband and wife (in the notation of Figure 3.4, US:UM::FS:FW).

For Lévi-Strauss the atom of kinship provides the basic building block out of which all systems of exogamy are constructed. Its internal relationships define the laws employed by concrete thought to establish the exchange of women. Whereas in contemporary society "complex" rules only determine a subject's relatives (relying upon the law of averages to achieve the distribution of women), primitive cultures often employ systems of "direct" exchange. Such marriage rules, which have been documented throughout the world, partition the society into groups of acceptable spouses and legislate the


(±)
(±)
Father (F)
=
Mother (M)
Uncle (U)
(±)
(±)
Sons (S)
+ signifies familiar relations
- signifies reserved relations
R
C
N

Trobriand

	M	S
F	+	+
U	-	-

Tonga

	M	S
F	+	-
U	-	+

Sinai

	M	S
F	-	+
U	+	-

Cherkess

	M	S
F	-	-
U	+	+

Figure 3.4. The Atom of Kinship (adapted from Lévi-Strauss, 1967b)

trading of females between them. It is Lévi-Strauss's (1949/1963) thesis that these "elementary" structures reveal the mind in its first historical endeavor to create a cultural space. For this reason Lévi-Strauss (1949/1963) follows Durkheim and Radcliffe-Brown, among others, and conducts his analysis on the isolated aboriginal tribes of Australia.

Lévi-Strauss (1949/1963) claims that all kinship systems can be constructed through the combination and generalization of just three elementary structures. The simplest, based upon moieties normally determined by matrilineal or patrilineal descent, unites two groups through the direct exchange of women. This may be elaborated into a four section system (or such a structure may originate spontaneously) by further restricting marriage only to cross cousins. In the Kariera system, for example, the tribe is split into four "hordes" through laws that partition every member of the society in terms of consanguinity, locality, and descent, a regime that he explains through the use of an analogy.

Two families, the Duponts and the Durands, who live throughout France, must intermarry. Contrary to our custom, children inherit their mother's name, thus producing a matrilineal moiety within the society. However, two cities, Paris and Bordeaux, require married couples to reside in town of the husband's birth, thus creating four social classes that will be perpetuated through time. The possibilities for marriage and offspring are:

Man	Woman	Children
(A) Durand of Paris	(D) Dupont of Bordeaux	(C) Dupont of Paris
(B) Durand of Bordeaux	(C) Dupont of Paris	(D) Dupont of Bordeaux
(C) Dupont of Paris	(B) Durand of Bordeaux	(A) Durand of Paris
(D) Dupont of Bordeaux	(A) Durand of Paris	(B) Durand of Bordeaux

These laws may be summarized in the following table.

Woman

Man	A	B	C	D
A				C
B			D	
C		A		
D	B			

Child

As Lévi-Strauss observes these kinship laws bond the four classes together with three relationships: marriage plus descent (M), locality plus descent (L), and marriage plus locality but not decent (N). Although he does not formally recognize the resulting structure, Lévi-Strauss has actually described a Klein four group, where the clans A, B, C, D are linked together through a system of rules defined in the table below.

	A	B	C	D
A	I	N	M	L
B	N	I	L	M
C	M	L	I	N
D	L	M	N	I

If the Kariera system is the solution produced by the unconscious mind to the problem of bonding four groups, the Aranda achieve a parallel end with a third elementary structure by uniting eight hordes in a similar binary network of direct exchange. This system permits marriage only between the descendants of cross-cousins (Lévi-Strauss 1949/1963, pp. 162-167).

Since my intention is not to labor over the details of Lévi-Strauss's extensive analysis of kinship systems, but rather to describe the aims and methods of his inquiry into the structured mind, I shall pass on to the next phase of his work. However, before continuing I shall pause briefly to recognize the highly controversial nature of his claims. To summarize just a few arguments: Korn (1978) points out that the incest taboo concerns sexual liaisons and cannot logically be tied to rules regulating marriage. Clarke (1981) argues that kinship systems are not based upon the innate mechanisms of the mind, but are cultural products that reflect a variety of economic and social needs. I might also add that since one of Lévi-Strauss's central arguments for the principle of reciprocity is founded on his somewhat premature reading of the debate between Piaget and Susan Issacs, he cannot claim the continuity of thought between adults and children that this thesis demands (Gardner, 1981). I will return to this issue in Chapter 5. Finally, as with other areas of Lévi-Strauss's work, critics have complained of his tendency to import structures into experience rather than discovering them within the phenomena. As Clarke (1981) complains, it is hardly surprising that Lévi-Strauss is able to explain all aspects of primitive culture so neatly when each term he articulates has already been impregnated with a binary structure. (For more specific criticisms of Lévi-Strauss's theory of kinship see Clarke, 1981; Korn, 1978.)

Totemism and the Savage Mind

Norbert Wiener published his influential book, Cybernetics, in 1948. One of the issues he addresses is the demarcation of science from other areas of inquiry. In essence, Wiener--like Kant--argues that the phenomena under study must be susceptible to mathematical analysis and that it must be possible to factor out the interactive effect of the researcher from the investigation. On both counts, he believes, social studies are pre-scientific. Lévi-Strauss accepted these conditions and, in Structural Anthropology (1967b), claims that his adoption of Saussure's model of langue enables sociological inquiry to meet these criteria and so become a true scientific enterprise. First he argues that since language is a psychological universal, it provides the key to the organization of cultural phenomena. Second, there exists no interface between the researcher and the object of study, the categories of mind, since unconscious rules are not affected by the observer's presence. As Lévi-Strauss (1967b) sums up his proposed structuralist science of society,

> First, structural linguistics shifts from the study of conscious linguistic phenomena to study their unconscious infrastructure; second it does not treat terms as independent entities taking instead as its basis of analysis the relations between terms; third it introduces the concept of system. . . . Finally, structural linguistics aims at discovering general laws, either by induction or . . . by logical deduction which would give them an absolute character. (p. 31)

During the central period of his work, Lévi-Strauss applied this "scientific" method to substantiate structuralism's anti-evolutionary claims. In 1962, he published two books. The first was Totemism, an historical and critical account of how anthropologists and philosophers since Durkheim had attempted to decipher the meaning of totemic classifications. The second, The Savage Mind, became Lévi-Strauss's most popular and influential work, combining a spirited attack on Sartre's humanism with many examples of the similarities between native thought and modern scientific reason.

Since the turn of the century, most anthropologists believed that the mental powers required for a scientific understanding of the world were beyond those displayed by natives living in primitive societies. Like Levy-Bruhl, many were convinced that such cultures should be compared with the intellectual stage of childhood, and so put forwarded a social version of the phylogeny recapitulates ontogeny hypothesis (Lévi-Strauss, 1949/1969, pp. 84-97).

For Lévi-Strauss, however, the primitive's mental structures, although occupied with a more impoverished content than a modern Western persons, nonetheless shares the same form. His argument is developed on two fronts. First he offers numerous examples of how primitive reasoning is, in fact, scientific. Then he demonstrates that modern thought employs exactly the same processes as its native counterpart. Indeed, in a remarkable passage, Lévi-Strauss (1962/1969, p. 98) pokes fun the at elitest attitudes of contemporary philosophers by demonstrating how a Sioux myth espouses the same metaphysics of experience as that argued for by Bergson. Of course Lévi-Strauss does not think that a native's view of the world can be compared with the power of scientific reasoning. His point is rather that both modern and primitive subjects engage in the same form of classificatory activity. The difference is that the primitive must base his or her understanding of reality upon immediate sensory phenomena, whereas the scientific mind has developed conceptual categories that order experience abstractly. The former, in searching for a comprehensive understanding of the world, is prepared to accept the contradictions that are generated by overlapping ideas. In contrast, scientific thought, while retaining this "totalizing" attitude, critically develops disjoint concepts in the historical process of forming an adequate representation of experience. Education in contemporary society is an initiation into the mode of thought facilitated by these ideas. In contrast, the primitive must form an understanding of the world through the discriminations that sense perception makes possible. However, Lévi-Strauss maintains that the same basic process underlies both modern scientific reasoning and the logic of concrete thought. He illustrates his argument by invoking the image of a bricoleur, a kind of handyman, who, unlike a craftsman or a mechanic, repairs broken machines, artifacts, and other damaged items with whatever materials are close at hand. These methods are clumsy and often lack direction, yet the solution, although based upon makeshift parts and trial and error reasoning, does reveal a scientific quality to thought. In a similar manner, primitive reasoning and the organization of the world in terms of myth, totem, and taboo is a kind of intellectual bricolage.

Out of the divisions constructed through sensory awareness, the fundamental problems of existence must be addressed. Myths, like the patchwork repairs of the handyman, are solutions to philosophical and social questions built out of the spare parts of the native's understanding. The same is true of totemic classifications. In Lévi-Strauss's terms, primitive men and women separate their world into various domains and associate them with animals or plants, not because such categories are "good to eat," as Radcliffe-Brown thought, but because "they are good to think with." The environment provides an enormous range of such natural categories that can be classified into a differentially related network suitable for concrete thought. Add to this the possibility of further divisions, from species to individual to parts of body, and the structured mind has in the "totemic operator" a conceptual tool of great complexity and sophistication (Lévi-Strauss, 1966, pp. 152-154).

The totem acts as a code enabling primitive societies to construct their community out of the world around them. So, for example, the relationships that natives perceive between the eagle and the bear or the snake and the boar are used to make a statement about their own life and their position in the social world. Accordingly, it is not a similarity between the totem and the animal that stands out, but an ontological resemblance between its life and the social organization of the clan system. Thus, when the Neur say that the birds are their twins, Lévi-Strauss (1962/1969) regards this as an analogical comparison demonstrating how the structure of Neur society parallels that of the relationships perceived in the behavior of birds. For Lévi-Strauss (1966) what characterizes "the savage mind"

> is its timelessness; its object is to grasp the world as both a synchronic and a diachronic totality and the knowledge which it draws therefrom is like that afforded of a room by mirrors fixed on opposite walls. . . . A multitude of images forms simultaneously, none exactly like any other, so that no single one furnishes more than a partial knowledge of the decoration and furniture but the group is characterized by invariant properties expressing a truth. The savage mind deepens its knowledge with the help of images mundi. It builds mental structures which facilitate an understanding of the world in so much as they resemble it. In this sense savage thought can be defined as analogical thought. (p. 263)

Indeed, Lévi-Strauss makes much of society's relationship with animals. In The Savage Mind he seems to delight in his analysis of the common names we use for pets and domestic animals. Dogs, for instance, because of their close relationship to people, are given stage names that reflect their not quite human status. Birds, in contrast, because they are so different, can be awarded human names; however, these seem to be applied to the whole species rather than to individuals. So whereas particular dogs may be called Rover, Lucifer, Spot, and Fido, we tend to talk of birds in terms like Robin Redbreast, Polly Parrot, and Tom Tit. What Lévi-Strauss suggests here is that we implicitly recognize our relationship to these sets of animals and express it either metaphorically or metonymically in such naming practices. More precisely, Lévi-Strauss (1966) argues--again employing the law of symmetrical inversion that if a metaphorical relationship exists between human society and a certain group of animals, then metonymical naming practices will be followed (as evidenced in the case of birds). Conversely, if we share a metonymical proximity, as we do with dogs, then metaphorical names will be chosen. This argument, like the cooking example, is somewhat stretched by Lévi-Strauss to fit these classifications into the symmetric categories shown in Figure 3.5.

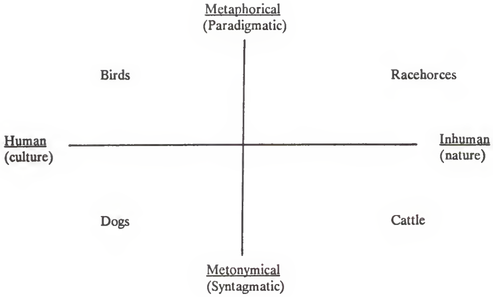


Figure 3.5. Lévi-Strauss's Model of Animal Naming Practices

The reader will notice once again that these categories can be combined to form a Klein four group that models mathematically the relationships that Lévi-Strauss (1966) sums up in the following passage.

> If, therefore, birds are metaphorical human beings and dogs are metonymical human beings, cattle may be thought of as metonymical inhuman beings and racehorses as metaphorical inhuman beings. Cattle are contiguous only for want of similarity, racehorses similar only for want of contiguity. Each of these two categories offers the converse image of one of the two other categories, which themselves stand in the relation of inverted symmetry. (p. 207)

The question of how to interpret this strange analysis is compounded by its apparent deviation from fact. As Leach (1970) recognizes, while the French may well name their animals according to such conventions, do not other societies employ significantly different norms? Yet such criticisms miss Lévi-Strauss's point. What we call our pets and domestic animals is clearly a function of our social relationship with them, and this may well vary from one culture to another. Lévi-Strauss is not looking at the content of our social practices, but rather at the syntactic form of our thought in order to demonstrate the working of the structured mind. His point is that since we do not have any scientific procedures for naming animals, contemporary men and women, like their primitive counterparts, employ the same analogical logic of concrete thought by using the perceived differences from one domain to create order within a second. That is, we unconsciously recognize our relationships with such animals through the application of human names, in just the same way that native cultures reflect on themselves by employing totemic classifications.

It is essential to realize that Lévi-Strauss's choice of subject matter is only of secondary importance in comparison to his central objective of revealing the universality and necessity of thought. So, while many commentators are sharply critical of Lévi-Strauss's disciple-like desire to fit all his data into the Jakobsonian model of binary oppositions (Leach, 1970, p. 40), they do not always object to the direction of his argument. It is the apparent intellectual games that Lévi-Strauss plays in the analysis of culture and the eccentricity of his subject matter that most disturbs his readers. By revealing the fundamental character of mind in such unlikely areas as society's cooking practices and the naming of animals, Lévi-Strauss's work is at once surprising, original, provocative, and controversial.

Yet the strangeness that causes many to dismiss his work is, ironically, one of the central themes of Lévi-Strauss's thesis. Things are not simply as we perceive them, and the explanations that we give for our behavior hide a deeper internal structure. Like Freud's psychoanalysis, Lévi-Strauss's application of langue is an attempt to reveal this inner organization. Just as Freud's subject may weave an elaborate conscious explanation to hide an underlying neurosis, so modern men and women have established an intricate network of social practices that mask the fundamental workings of the mind. For this reason anthropological studies of primitive life provide examples of social practices that reveal the categories of thought more clearly. So by studying the structure of myth, kinship practices, taboo, and magic in native cultures, Lévi-Strauss can achieve the same analysis of mind as he would were he to investigate the basis of science, religion, and morality in the modern world. Again, this is not to deny the more objective basis of these modes of thought, for, as I have explained, they rest upon critically examined categories. It is merely to stress that for Lévi-Strauss the same form of reasoning underlies both modern and primitive reasoning. It is ironic then, that the title of the book in which Lévi-Strauss seeks to establish this structural homology of mind, La Pensée Sauvage, has been translated into English as The Savage Mind. Clearly he does not wish to equate the primitive with the English language notion of "a savage," which conjures up the image of an animal. Rather, echoing Rousseau, Lévi-Strauss regards native life as one of poetic simplicity, lived in harmony with nature. Like the wild pansy that decorates the cover of the book's French edition (an alternate translation of "la pensée sauvage"), each primitive culture is seen as a beautiful yet fragile experiment of nature delicately balanced within a particular environmental niche. For Lévi-Strauss there are no superior societies since each may be reduced to the same set of mental operations. With characteristic pessimism, Lévi-Strauss camgaigns for the preservation of these unique and indivisible expressions of the human spirit while watching their destruction as Western society blindly devours the world in order to establish its own monoculture.

Myth

The third part of Lévi-Strauss's oeuvre is devoted to the study of myth. His magnum opus, the four volume Mythologies, is a systematic analysis of hundreds of American Indian myths that purports to demonstrate how each story represents a single part in a holistic organization of tales that may be traversed through a series of algebraic transformations. According to Lévi-Strauss, this mythic universe is the product of the unconscious mind's continuous attempt to reconcile the implicit discontinuities inherent in the emergence of culture from the natural world.

Lévi-Strauss is drawn to the study of myth for the same reason that Chomsky investigates language. They share the belief that an arbitrary and unlimited content is governed by universal laws of syntax. Since within the realm of myth, unimpeded in its choice of characters, the unconscious has carte blanche to construct whatever explanations are necessary to its task, the workings of the intellect can be observed in their most perspicuous form.

Lévi-Strauss's mature view of myth represents something of a departure from his initial studies first published in Structural Anthropology (1967b). Originally he had argued that myths are socially engineered solutions to philosophical problems, tools that mediate competing ideologies and beliefs through a metaphorical synthesis. In his later writings the human subject that becomes the instrument of the myth, as the implicit discontinuities it poses within experience, are patched-up by the symbolic permutations of unconscious thought. Myths are no longer generated by oppositions. It is rather oppositions that exist within the world of myths. To explain the sense of this position and Lévi-Strauss's developing focus on the idiolect, I will describe his early thoughts on the logical structure of myth and discuss the elaboration of these arguments in the Mythologies.

Myths are not fairy tales. In Lévi-Strauss's initial investigations they are represented as the means by which primitive cultures resolve the essential philosophical and moral problems of life. On this view myths are seen as a metaphorical tool for mediating the competing claims of rival ideologies and beliefs. They incorporate a kind of a temporal amalgamation of fact and fantasy, where men, women, animals, culture, and nature are juxtaposed in an effort to explain the meaning of social existence. For example, many myths deal with the origin of the first human in order to reconcile the implicit contradiction of the birth cycle. Others, as we have seen, explain the basis of taboos or cooking practices, whereas some account for the existence of society. What is significant is the way that myths combine the bits and pieces of the world and like the bricoleur attempt to fashion a solution to such problems without concern for the intrinsic nature of the parts they employ. The results of this endeavor satisfy the native's intellectual curiosity and unite the community by propagating the acquired wisdom of past members. As such, myths establish a kind of equilibrium through which men and women can come to grips with their role in society and focus upon what ends they may legitimately aspire to in the course of their lives. In fact, Lévi-Strauss believes that because primitive subjects tend to collect ideas--rather than refining and fragmenting them--they typically attain a greater degree of "psychic equilibrium" than do their modern counterparts. In contrast to primitive people, 20th century men and women face the world with concepts that are separated from the context of their daily lives.

In order to address these dilemmas, some of the oppositions that exist in the natural world are adopted as the prototype symbols of cultural value. Man-woman, day-night, hot-cold, and other sets of opposites are used to represent the good and the bad, that which is allowed and that which is forbidden. These "binary" pairs then are woven into a diachronic story that takes on the status of a socially sacred tale. When the myth is told to the young or invoked in the resolution of some social problem, it implicitly passes on a message that serves to indoctrinate the members of the group. To unravel the structure of this message, according to Lévi-Strauss, is to lay bare the logic of the human mind, for the myth presents the structured mind with an unconscious network of opposition, formed out of the conceptual bric a brac of the native's world, in order to stage (if not resolve) an important philosophical question. This synchronic structure is woven in and out of the story, as the narrator repeats central oppositions of the tale in a manner Lévi-Strauss (1971) likens to the cycles of a musical theme.

It may appear that the meaning of a myth unfolds with the telling of the tale, that like other stories it is the sequential relationship between sentences that gradually reveals its purpose. But for Lévi-Strauss the message contained in a myth is encoded in a much more subtle way that may not even be recognized by the native. However, it will be appreciated.

> Music fulfills a role comparable to that of myth. A myth codes in sounds rather than words, the musical work provides an interpretative grid, a matrix of relations which filters and organizes lived experience, substitutes itself for hired experience and produces the blessed illusion that contradictions can be overcome and difficulties resolved. (p. 589)

In Structural Anthropology (1967b) Lévi-Strauss proposes the following method of analysis. Each myth should be thought of as an integrated collection of themes rather like the combined sound produced by the individual instruments of an orchestra. By assigning each of these components a number, the myth can be represented by a linear succession of terms. The themes it incorporates can then be identified by arranging these numbers in vertical columns as illustrated in Figure 3.6. This collection of numbers resembles Jakobson's phonetic analysis of a sentence, the vertical axis representing the individual phonemes and the horizontal axis their combination into a succession of meaningful sounds. In a similar manner, Lévi-Strauss suggests that each number can be regarded as a "mytheme," the smallest unit of meaning in the story. So by identifying these basic constituents of information, the whole myth can be deconstructed into a number of short sentences. Taken by themselves, mythemes have no meaning. Rather, the system of binary relations threading them together in a langue-like structure of oppositions defines the semantic field of the myth. Clearly, different societies resolve the same important questions by inventing their own particular myths. However, Lévi-Strauss maintains that even though the content of these stories may vary radically, their structure should remain constant. Consequently, algebraic transformations can be derived to reveal the fundamental identity of thought immanent in the construction of all myths.

The most accessible illustration of this procedure for the reader unfamiliar with native stories is Lévi-Strauss's (1967b, pp. 208-215) analysis of the Oedipus myth. First, breaking the tale down into its essential components, the mythemes shown in Figure 3.6 emerge. These mythemes then are arranged in a table. Each column represents one pole in a binary opposition. Columns A and B signify the relative importance the characters attach to blood ties over social relations, and columns C and D indicate the dilemma of our origin stated in the problem of autochthony--birth from the earth without human aid. (It is the obvious question of how the first human beings came to be.) Column A represents the social problems that result from intimate relations between family members, whereas column B addresses the opposite issue, the under-evaluation of kinship ties, by describing what happens when blood relatives kill one another. Similarly, in the other two columns, the opposition between being born from the earth--a single source--and being born of the union of two sexes is demonstrated by identifying lameness (a standard mythical association) with antochthony, on the one hand, and then demonstrating society's power over nature through the slaying of monsters, on the other. Consequently, the relationship between columns A and B is mirrored in the opposition between C and D. Further, the two oppositions themselves stand as contraries in the need to reconcile cosmological beliefs with the biological realities of life.

1) Cadmos pursues his sister who has been raped by Zeus.
2) Cadmos kills the dragon, whose teeth fall into the earth and arise as warriors.
3) These warriors, the Spartoi, kill each other.
4) The next king is Labadacus (the lame), whose son is Laius (the left-sided).
5) Laius tries to kill his infant son Oedipus (the swollen-footed).
6) Oedipus kills his father.
7) Oedipus forces the Sphinx to commit suicide.
8) Oedipus becomes king by marrying his mother Jocasta.
9) Realizing his crime, Oedipus blinds himself, becomes exiled and is unable to walk without help.
10) Oedipus's twin sons Eteocles and Polynices, battle for the kingdom and kill each other.
11) Antigone disobeys the new king, her uncle, and buries her brother Polynices.
12) Antigone dies because of this.

A	B	C	D
1			2
	3	4	
	5		
	6		7
8		9	
	10		
11	12		

Figure 3.6. Lévi-Strauss's Anaylsis of the Oedipus Myth (adapted from Lévi-Strauss, 1967b)

In the Naked Man (1971), Lévi-Strauss argues that many myths are arranged "like Klein groups including a theme, the contrary of the theme and their opposites" (p. 649). On the basis of these instructions, the Oedipus myth can thus be thought of as a system of communication that ties its basic themes together in the following structural network (where I, N, R, and C represent the oppositions implicit in the story).

	A	B	C	D
A	I	N	R	C
B	N	I	C	R
C	R	C	I	N
D	C	R	N	I

The point of this and other myths is not to solve culturally generated problems, for in a sense myths deal with those issues that cannot be resolved. The Oedipus myth addresses one of the great puzzles of life, not with the intent of dismissing or trivializing one claim in respect to another, but to establish some form of equilibrium between the competing yet contradictory facts of social existence. As Lévi-Strauss (1967b) argues,

> the myth has to do with the inability, for a culture which holds the belief that mankind is autochthonous . . . to find a satisfactory transition between this theory and the knowledge that human beings are actually born of man and woman. Although the problem obviously cannot be solved, the Oedipus myth provides a kind of logical tool which relates to the original problem--born from one or born from two?--to the derivative problem born from different or born from the same? By a correlation of this type, the overrating of blood relations is to the underrating of blood relations as the attempt to escape autochthony is to the impossibility to succeed in it. Although experience contradicts theory, social life validates cosmology by its similarity of structure. (p. 216)

It seems impossible to discuss the Oedipus myth without considering Freud. Indeed, Lévi-Strauss (1967b) argues that although the Greek version of this myth presented by Sophocles has undergone considerable transformations to reach its Freudian form, it nonetheless addresses an equivalent moral dilemma through a structurally identical conflict staged between father and son. Yet Freud's analysis of the Oedipus complex stands diametrically opposed to Lévi-Strauss's interpretation of the myth. For Freud (1913) believes this universal conflict is not the product of concrete thought is but an inherited psychic recollection of an actual event, an event that first bonded society together through the construction of totems and taboos and ultimately led to the historical development of religious faith in a father-like God. Freud thus offers a diachronic explanation of what Lévi-Strauss attempts to show is the synchronic product of a structured mind. Since Lévi-Strauss's account of the existence of culture might be regarded as a response to the evolutionary thesis presented in Freud's Totem and Taboo (1913), a brief comparison of these two positions serves to throw the structuralist theory into sharper relief.

In essence Freud (1913) proposed a Lamarckian vision in which the memory of a primeval conflict has been stored in our unconscious psyche. Basing his arguments on the writings of Darwin and the ethnographic reports of Frazer, Freud conjectured that human beings, like apes, once lived in hordes dominated by a powerful male who would jealously guard his females against all rivals (Lévi-Strauss, 1949/1963). On one occasion the male offspring of this leader united to kill (and devour) their father (who also was their ideal role image) in order to steal his mates. Yet, since none had the strength to replace him, the siblings, overwhelmed by guilt and fear, joined together to form a clan, identifying themselves with a totem that represented their father. This bond was then cemented by the establishment of two taboos: the totem and its followers may not be killed, and all sexual relations must be arranged outside of the clan. Here then was the origin of exogamy and reverence for an ideal that at one stroke provided "the beginning . . . of social organization, of religion and of ethical restrictions" (Freud, 1913, p. 176). For Freud the unconscious Oedipal drives are not biologically innate--as evidenced by their absence in matrilineal kinship systems--but are a consequence of an acquired memory, to be recalled through a form of Platonic amnesias as each individual brought up in a male dominated regime re-enacts this original murder phylogenetically. While Lévi-Strauss agrees with Freud that the incest taboo is the other side of the marriage rule, generating culture from nature, he rejects any attempt to retrace the genetic roots of society through either psychological or historical arguments. Such a universal phenomena, he believes, can only be explained through the common mental endowment of all human beings.

> The failure of Totem and Taboo, far from being inherent in the author's proposed design, results rather from his hesitation to avail himself of the ultimate consequences implied in his premises. He ought to have seen that phenomena involving the most fundamental structure of human mind could not have appeared once and for all. They are repeated within their entirety within each consciousness, and the relevant explanation falls within an order which transcends both historical successions and contemporary correlations. Ontogenesis does not reproduce phylogenesis, or the contrary. (p. 491)

So, whereas Freud thought the primitive horde and its cannibalistic act of patricide could be logically deduced from the existence of the incest taboo, Lévi-Strauss sees this as a gratuitous "myth" to be replaced by the simpler theory of the structured mind. On this account, to recall, the incest prohibition was an internal feature of the atom of kinship and is defined in terms of the relationship between brother and sister rather than that found between mother and son. Moreover, Lévi-Strauss maintains the popularity of the myth cannot be traced back to a single event. It is more satisfactorily explained as a common dream shared by many cultures. Just as in a number of primitive festivals where social mores are temporarily abandoned, so the Oedipus myth explores the consequences of behavior that runs counter to the basic laws of society.

If Lévi-Strauss first analyzed myths as logical instruments for reconciling conflicting ideologies, in the Mythologies he focuses solely on their syntactic structure. He argues that just as individual myths are created through an internal network of oppositions, so the structured mind, by combining and permeating terms, is able to produce a family of related stories. The result, when viewed throughout the Americas, is a great universe of interrelated myths. With Lévi-Strauss as our guide, the reader is led through this world passing from one myth to another by altering the characters in a tale as a mathematician moves variables in an equation. Since this network has no center, Lévi-Strauss starts his analysis by selecting a reference myth. In the first volume, The Raw and the Cooked (1969), a Bororo story is chosen that describes how a boy, who having raped his mother, is forced by his father to undertake several dangerous tasks only to return successfully and seek his revenge (pp. 35-50). Yet the real meaning of this myth becomes clear only when it is read in concert with several other stories told by the Tupi and Ge indians. In this context it can be seen as just one component in a vast cosmological tapestry of stories that seek to explain the emergence of society through the acquisition of fire and the development of cooking practices. The reference myth, it turns out, is "actually" about the origin of rain and wind, which Lévi-Strauss believes represent "anti-fire" and thus the forces of nature opposed to culture. In all, the 166 myths he analyzes from 20 different native tribes are reduced to the basic assertion that just as the sun controls the earth through its warmth, so human beings can create a social existence through the agency of cooking.

The group-like structure of the mythic universe is generated by cycles of permutations. Man is replaced by woman, earth by sun, and fire by water as the unconscious combines and interchanges the elements it perceives in the natural world in order to maintain its cognitive equilibrium. These operations are no longer seen as responses to social problems but are considered the consequence of implicit contradictions housed within existing myths. Now, for Lévi-Strauss, the human subject does not speak through the myth; rather it is the myth that speaks through us.

In The Naked Man (1971) Lévi-Strauss compares these "topological" transformations to D'Arcy Thompson's account of continuous variations within a zoological class. Just as morphological structure retains its same form when parameters are changed, so within a family of myths the same theme can be played out in a variety of different settings with a host of new characters. The point of the Mythologies, then, is not to determine the meaning of myths--for all its intricate contextual analyses of the native world--but to dissolve content, to remove all cultural and historical differences and lay bare the universal grammar of the human mind.

> What I am concerned to clarify is not so much what there is in myths . . . as the system of axioms and postulated defining the best possible code, capable of conferring a common significance on unconscious formulations which are the work of minds, societies and civilizations chosen from among those most remote from one another. (Lévi-Strauss, 1969, p. 12)

The structure of the mythic universe derives from two sources: on one hand, the cognitive and perceptual mechanisms of the subject, on the other hand, the intrinsic character of the physical world. Throughout the Mythologies Lévi-Strauss examines the social and natural environment of each culture in painstaking detail, cataloging the fauna and animal species in order to reconstruct the distinctive oppositional features of their life. From this stock of elements the unconscious mind selects the symbols to be employed in concrete thought. Lévi-Strauss (1971) also recognizes that our perceptual organs determine the structure of sense experience through their distinctive physical construction. In the final section of the Naked Man, for example, he argues that the retina organizes sensations and

> transmits to the brain . . . not so much figurative images as a system of binary oppositions between immobility and movement, the presence of absence of color, movement occurring in one direction rather than in others, a certain type of form from other types, and so on. (p. 678)

Sounding more like Kant, Lévi-Strauss (1971) continues.

> In other words, the operations of the senses, have from the start, an intellectual aspect, and the external data belonging to the categories of geology, botany, zoology, etc., are never apprehended intuitively in themselves, but always exist in the form of a text, produced through the joint action of the sense organs and the understanding. (p. 678)

Whereas for Kant the understanding was limited to the phenomenal realm and ordered by the categories, Lévi-Strauss places the mind back into nature and argues that our mental operations are governed by the same logic that structures the external world. It is ultimately the common genetic code that establishes the oppositional discontinuities found both within reason and within nature. As Lévi-Strauss (1971) puts it, "thought, and the world which encompasses it and which it encompasses, are two correlative manifestations of the same reality" (p. 678).

For Lévi-Strauss, then, as indeed for Chomsky, the quest for mind can be pursued on two fronts. The anthropologist and the linguist conduct "top-down" searches for cognitive universals in the products of human thought, whereas physiologists approach the same structures through a "bottom-up" neurological investigation of the brain. According to Lévi-Strauss, these inquiries are complementary, revealing a naturalistic continuity between the structures of the mind and the structures of nature, a homologue that Lévi-Strauss (1971) sometimes employs to support his ethnographic studies.

> When in La Pensée Sauvage (pp. 270-72), I interpreted the names we give to birds as indicting that their various species, taken as a whole appear to us as a sort of metaphorical counterpart of human society, I did not realize that an objective relation of the same type actually exists between their brains and ours. It would seem that mammals and birds, in evolving from their common source, the reptiles, followed two divergent paths as regards the development of the brain and arrived at complementary solutions. In the higher mammals, intellectual operations take place in the cortex, which surrounds the extensive area occupied by various components of the striatum. In birds, on the contrary, as if through the effect of a topological transformation, the same operations (using a code simpler than, but of the same type as, the one programmed in the cortex) are carried out by the upper part of the striatum, which constitutes almost the whole mass of the brain, and which partly surrounds a rudimentary cortex lodged in a furrow at the top. Insofar as a metaphor always consists of referring to a total, implied semantic field by means of a complementary part of the whole, we can say, then that in the field of possible cerebral organizations, the mammalian brain the bird brain present a metaphorical image of each other. (p. 691)

In Tristes Tropiques (1955) Lévi-Strauss explains his bitter disappointment when, after realizing the dream of every young anthropologist--making contact with a previously unknown culture, he was unable to forge any kind of meaningful communication. Separated by an unknown language, Lévi-Strauss at once had both his "reward and his punishment." The personal barriers he faced could only be broken down at the expense of the very prize he sought. For as his Brazilian travels had shown so vividly, native contact with Western civilization only brings contamination and the inevitable destruction of a unique society. Death, it seems, is the ultimate irony of anthropological inquiry.

Yet, reflecting upon this impasse, Lévi-Strauss (1955) recognized that the primitives he had met were hidden only by their superficial differences. Beneath their exotic and unfamiliar practices stood the same rational mind. As Geertz (1973) explains, through this revelation Lévi-Strauss finds the key to a new science of mind.

> The mind of man is, at bottom, everywhere the same; so that what could not be accomplished by a drawing near, by an attempt to enter bodily into the world of particular savage tribes, can be accomplished instead by a standing back, by the development of a general, closed, abstract, formalistic science of thought, a universal grammar of the intellect. It is not by storming the citadels of savage life directly, seeking to penetrate their mental life phenomenologically (a sheer impossibility) that a valid anthropology can be written. It is by intellectually reconstituting the shape of that life out of its filth-covered "archaeological" remains, reconstructing the conceptual systems that, from deep beneath its surface, animated it and gave it form.
>
> What a journey to the heart of darkness could not produce, an immersion in structural linguistics, communication theory, cybernetics, and mathematical logic can. Out of the

> disappointed romanticism of Tristes Tropiques arose the exultant sciencism of Lévi-Strauss's other major work, La Pensée Sauvage. (pp. 350-151)

The Mythologies represent the final and definitive statement of Lévi-Strauss's science of the structured mind, a marriage, as Geertz (1973) observes, of scientific naturalism and the enlightenment rationalism of Rousseau.

Conclusion

Lévi-Strauss and Kant

Lévi-Strauss was initially drawn into anthropology in an attempt to escape what he regarded as the indulgent and subjective methods of his philosophical training. Above all he rejected the belief that the structure of experience could be determined through the process of introspection. Like Freud, Marx, and Durkheim, Lévi-Strauss was committed to the view that individuals are ruled by unconscious forces and that the confusion of phenomena--in all realms--is a superficial mask to a deeper logical organization. Yet, unlike Marx and Durkheim, Lévi-Strauss does not believe that this structure is created by social institutions. Rather, it is a feature of the innate psychological make-up of the brain.

One of the most powerful themes in the structuralist movement is the decentering of the subject. For Lévi-Strauss this implies that the traditional philosophical deduction of the categories through the examination of consciousness must be abandoned for a scientific investigation of thought. The transcendental ego cannot claim a privileged access to the structures of mind simply because it is the instrument of inquiry. Indeed, for Lévi-Strauss our inner thoughts only yield a second and more confused realm of empirical experience. So unlike Kant, who explored the understanding a priori, Lévi-Strauss proposes to study the mind scientifically through ethnography. However, it is important to recognize the positive role that phenomenology plays in this inquiry. Lévi-Strauss does not reject the introspection of consciousness tout court. He simply believes that our inner thoughts are structured by the same set of innate mechanisms that organize the observable products of cultural life. So while the private domain of personal thought is too subjective a base for the scientific investigation of mind, Lévi-Strauss like Chomsky, believes that the structures derived from ethnographic studies should generate a semantic field that will be in accord with the subject's. Phenomenology thus provides structuralism with a means of verification.

By studying the universal structures of thought in the diverse cultural practices of primitive societies Lévi-Strauss is attempting to achieve through psychology what Kant tried to attain through philosophy. Both seek the innate categories that unconsciously constrain thought and arrange perceptions into a comprehensible unity. In contrast to Hegel, Marx, and Durkheim, both accept the primacy of the individual idiolect and reject the historical development of mind. Where they differ lies in their respective methods of analysis rather than their common aims. By rejecting the realm of consciousness for an objective science of the mind, Lévi-Strauss is indeed, as Ricoeur (1963) characterizes him "a Kantian without a transcendental subject" (p. 4), a description that Lévi-Strauss (1969) seems happy to acknowledge.

> Starting from ethnographic experience, I have always aimed at drawing up an inventory of mental patterns to reduce apparently arbitrary data to some kind of order and to attain a level to which a kind of necessity becomes apparent underlying the illusion of liberty. . . . In allowing myself to be guided by the search for the constraining structures of mind, I am proceeding in the manner of Kantian philosophy. (p. 10)

Not only do Lévi-Strauss and Kant share a commitment to the thesis of the structured mind, but, under the influence of Rousseau each one has developed and applied this epistemological theory to a similar set of practical concerns. Inspired by Rousseau's vision of humanity's inner moral goodness, enlightenment philosophers like Hume (1748/1975) and Kant placed their faith in the universal rational capacities of all men and women.

> It is universally acknowledged that there is a great uniformity among the actions of men, in all nations and ages, and that human nature remains still the same in its principles and operations. . . . Mankind are so much the same, in all times and places, that history informs us of nothing new or strange in this particular. (pp. 92-93)

Rousseau, who Lévi-Strauss credits as the first ethnographer, emphasizes the common thread of human nature that runs through all forms of social life. Placing the individual before both society and history, Kant crystallizes this belief by defending the integrity of other cultures against Western ethnocentricity. By seating the laws of thought in the fixed immutable structures of the human mind, Kant (1787/1964), two centuries before Lévi-Strauss, establishes the moral primacy of the individual.

> As Newton was the first to discern order and regularity in nature, Rousseau was the first to discover beneath the varying forms human nature assumes, the deeply concealed essence of man and the hidden law according to which providence is justified. (p. 166)

Campaigning against the deceit of colonialism, Rousseau cautions that so called "civilized" society is not the product of historical progress but the result of corrupt and competitive passions. In Emile (1755/1950), for example, he despairs at humanity's fall from innocence. "Nature made man happy and good and society depraves him and makes him miserable" (p. 6). Echoing this pessimism, Lévi-Strauss shares the same distrust for history. Comparing primitive and modern cultures to mechanical and thermodynamic machines, Lévi-Strauss describes how native societies exist in a closed system that retains a balance with the environment. Alternately, Western culture--like a steam engine--hungers for "progress" by devouring the world around it. So in the Savage Mind (1966), Lévi-Strauss turns the tables on Sartre by arguing that the evolutionary view of history--as development--is nothing but a contemporary myth constructed to legitimize the destruction of primitive cultures.

> The prodigious wealth and diversity of habits, beliefs, and customs is allowed to escape; and it is forgotten that each of the tens of hundreds of thousands of societies which have existed side by side in the world or succeeded one another since man's first appearance, has claimed that it contains the essence of all meaning and dignity of which human society is capable. But...a good deal of egocentricity and naivety is necessary to believe that man has taken refuge in a single one of the historical or geographical modes of his existence, when the truth about man resides in the system of their differences and common properties. (p. 249)

According to Lévi-Strauss (1966), history is entropy, bringing disorder to the initial equilibrium between society and nature.

For Lévi-Strauss, and--as I will show in the next chapter--for Chomsky, the individual stands before society. Like Kant and Rousseau, these structural scientists of the mind deny history and the development of reason for a view of a common humanity. But their contemporary rationalism is brought to the 20th century by an epistemology that rejects the creativity and spontaneity of life cherished by the enlightenment. For instead of being cast in the image of God, human beings are viewed as biologically programmed symbol processing machines. Where anthropology once was the study of customs, beliefs, and social institutions, now under Lévi-Strauss's guidance it is an inquiry into the computational structures of the mind.

Criticisms

If there is a single conclusion to be drawn from Lévi-Strauss's life work, it is that the human mind, itself a part of nature, unconsciously generates the world of culture through its innate binary mechanisms. As Geertz (1973) says,

> what Lévi-Strauss has made for himself is an infernal culture machine. It annuls history, reduces sentiment to a shadow of the intellect, and replaces the particular minds of particular savages in particular jungles with the Savage Mind immanent in us all. It has made it possible for him to circumvent the impasse to which his Brazilian expedition led--physical closeness and intellectual distance--by what perhaps he always really wanted--intellectual closeness and physical distance. Like Rousseau, Lévi-Strauss's search is not after all for men, whom he doesn't much care for, but for Man, with whom he is enthralled. It is, as much in La Pensée Sauvage as in Tristes Tropiques, the jewel in the lotus he is after. The "unshakable basis of human society" is not really social at all but psychological--a rational, universal, eternal, and thus (in the great tradition of French moralism) virtuous mind. (p. 358)

The philosophical naturalism that funds Lévi-Strauss's structuralist science of society is both realist and reductionist. Like Chomsky, he believes that the nature of mental structures may be inferred from empirical observations in a similar manner to the way that a physicist develops theories about the external world. Further, since the laws of social order like the rules of Chomsky's generative grammar are produced by fixed psychological mechanisms, culture can be reduced to the physical make-up of the brain and explained by the same forces that shape the natural world. In short, both Lévi-Strauss (1969) and Chomsky (1980b) share the objective of replacing sociological explanations that invoke human intentions and purposes with a scientific account of behavior written (like the laws of physics) solely in terms of the abstract rules of mathematics.

While I will return to the issue of methodological individualism in Chapter 5, it seems appropriate to center my present criticisms on Lévi-Strauss's attempt to explain social phenomena through the biological properties of the brain. Ironically, this reduction seems to parallel the empiricist program--so aggressively criticized by both Lévi-Strauss and Chomsky--of explaining human behavior purely in terms of the environment. That is, while empiricists seek to describe the phylogenetic development of the mind through the subject's activity with a structured world, so the "new rationalists" pass the argument to evolutionary theory to account for the ontogenetic origins of the brain in terms of the behavior of the species. Yet according to Piaget (1970), each form of reduction commits opposing errors. Whereas behaviorists focus on the origin of thought and ignore its organization, Chomsky and Lévi-Strauss emphasize the structure of the mind at the expense of its genesis. The result is a transformation of epistemological questions into the biological domain and the ultimate explanation of mind through the fortuitous results of chance mutations. For Piaget, as we will see in Chapter 5, this Darwinism is as scandalous as Kant's a priori deduction of the categories was for Hegel.

In the remainder of this chapter I shall evaluate Lévi-Strauss's arguments for this program through the following two questions. First, "Is it possible to understand social practices as a product of abstract intellectual structures?" Second, "If Lévi-Strauss's project is accepted, are the methods he prescribes suitable to this end?" I will reject both claims and defend the view that human behavior must be understood in terms of reasons as well as causes.

Can the richness of mythic thought and the logic of kinship structures be reduced to a set of underlying binary opposites? Like Chomsky (1957), who considers syntactic form to be independent of semantic content, Lévi-Strauss systematically ignores the drama and religious significance of native myths. But as Caws (1988) argues, if myths were presented in a comic strip, "there would be huge exclamation points everywhere and balloons saying ZIZZ! and SPLAT! and KABOOM!" (p. 117). However, none of this excitement ever enters into Lévi- Strauss's analysis. Even the participant's understanding of the story is passed over in favor of an unconscious play of proto-symbols. Yet as Lévi-Strauss's earlier studies show, these symbols, and the myths they speak through, address a socially defined world. Lévi-Strauss (1966) clearly acknowledges this in his distinction between concrete logic and the historical development of scientific thought. While it does not follow that the primitive mind is in some sense infantile in contrast to its modern counterpart, as Levy-Bruhl believed, it seems impossible to escape the conclusion that the logic of thought must be related to the nexus of meaning that defines human life.

Through his detailed and extensive analysis of myth, kinship systems, and the logic of totemic classification, Lévi-Strauss has clearly demonstrated that there is an underlying structure to primitive thought. In Chapter 4 we will see that the same conclusion can be drawn from Chomsky's studies of syntax. However, it is a non sequitur to assume, as these authors do, that the rules of deep structure they identify are psychologically real. It is quite plausible, for instance, to view such phenomena as social facts, existing beyond the psychological states of individual minds in Popper's (1979) objective "world 3." On this account, the inner structure of a family of myths is a simple consequence of their historical construction. Indeed, it might be argued that the very existence of the mythic realm depends upon a set of socially meaningful symbols that have acquired some systematic organization. Given such a network, new stories may be quickly devised by combining and replacing culturally significant characters in novel ways. Through time those permutations that retain the structural integrity necessary for survival within the oral tradition, while proving interesting or entertaining to the native, will be included in the corpus of social knowledge developed by the culture. On this interpretation it is not the structured mind that determines the generation of new myths, but the historical and ideological development of the community's interests.

In short, for Popper the structure of the mythic universe is a consequence of social purposes and meanings that transcend explanations solely in terms of individual agents. Lévi-Strauss's claim that the emotional and religious themes contained within myths are the work of a rational intellect logically manipulating arbitrary symbols leads to the fantastic conclusion that these often violent and sexually explicit stories have nothing to do with basic human desires. For instance, rather than reading the Borro reference myth as an Oedipal conflict, which it quite markedly resembles, rape, incest, and parricide all are interpreted as symbols of proximity in the story of society's origin through its control of fire. Once again, it is Lévi-Strauss's commitment to the structured mind as the originator of culture that leads him to separate the rational from the "irrational" and place the latter on the side of nature. But while aggressive and sexual drives are suppressed by social norms, they are by no means extinguished. A Freudian reading of this myth, for example, would reveal it to be a culturally constructed fantasy, a story that, like native rituals, speaks to the frustrated desires of the primitive and allows the brief illusion of their satisfaction. For Freud the sexual and violent themes contained in myths are not proto-symbols devised by the unconscious mind to solve intellectual puzzles; rather, they are the products of sexual and aggressive drives.

Even if Lévi-Strauss's naturalism is accepted, it is by no means evident that the structural psychology of mind he proposes can be considered a science. From the outset it is clear that many of the terms employed in his pseudo-logical equations are not the binary pairs he claims them to be. Honey and tobacco, anteater and jaguar, and sun and moon do not stand to one another as 1 does to 0. Yet throughout the Mythologies such polarizations are manipulated as complements within algebraic transformations. Indeed, it often seems, even to the sympathetic reader, that Lévi-Strauss is forced to import artificial divisions in order to conduct his analysis. Themes are borrowed quite unexpectedly from distant myths as Lévi-Strauss links stories that often are separated by hundreds of miles and as many years. Characters that only play a minimal role within a story often are greatly emphasized, whereas other myths are shown to concern topics that are not even mentioned. In the case of the Bororo reference myth, for instance, it is claimed that questions surrounding the origin of cooking practices are explored through the categories of wind and rain (anti-fire), even though the story makes no reference to such issues.

What is so strange about such arguments is that they are constructed quite independently of the participant's intentions. For the purpose of analysis, Lévi-Strauss (1969) suggests that we disregard "the thinking subject completely" and "proceed as if the thinking process were taking place in the myths, in their reflection upon themselves and their interrelation" (p. 12). So while Lévi-Strauss conducts extensive investigations of the natural environment in which a myth is set, he shows little or no interest in the meaning such stories have for the native. Indeed, he often is content to analyze second or third hand descriptions of myths reported by travellers or anthropologists who may have little knowledge of a culture or its language. Myth, Lévi-Strauss contends, unlike poetry, loses nothing in translation. Yet surely, by his own account, any structural investigation of a myth must turn upon the exposition of its basic themes and the set of internal relations they define. This, as I have argued, is only possible when the social context of the participant's thought is considered. But as Mayberry-Lewis (1969) points out, there are cases where Lévi-Strauss has made much of certain characters that seem to have been erroneously included in ethnographic reports, and which, when subsequently related back to the native are seen as quite alien to their comprehension of the myth.

Even for the ethnographer versed in the complexities of symbolism and structure, many of Lévi-Strauss's arguments seem quite bizarre. As Geertz (1973) complains, some of these

> essays in "socio-logic" are, like the analysis of totemism, persuasive and enlightening as far as they go. . . . Others, like the attempt to show that totemism and caste are capable . . . of being reduced to variant expressions of the same general underlying structure are at least intriguing if not precisely convincing. And others, like the attempts to show that the different ways in which horses, dogs, birds, and cattle are named form a coherent three-dimensional system of complementary images cross-cut by relations of inverted symmetry, are triumphs of self-parody. They are exercises in "depth interpretation" farfetched enough to make even a psychoanalyst blush. (p. 355)

The most commonly voiced criticism of this "scientific" method is that Lévi-Strauss does not discover these algebraic structures empirically but imposes an a priori mathematical model on the phenomena he investigates (Leach, 1970). It is not surprising therefore, that Lévi-Strauss can announce as his conclusion to the Mythologies that the unconscious mind classifies the world through the logic of binary oppositions, when throughout his four volumes of analysis the reader has been taught to interpret terms like "rain and wind" as "anti-fire." Such theory laden elements will, of course, quite naturally dovetail into the permutation equations that generate the mythic universe.

Lévi-Strauss's entire opus gives the impression that something quite profound is happening, as stories are logically transformed into one another. But Lévi-Strauss's mathematical structures are more transparent than those developed by either Piaget or Chomsky, and it is not difficult for the reader to recognize that the unity uncovered in mythic thought is more a function of the method of analysis than it is of the phenomena. In the end it is hard to avoid the conclusion that Lévi-Strauss has simply invented some elaborate word game complete with its own terminology and unique procedures in order to masquerade as a science. Indeed, structuralism has been characterized as a pseudo-science by several commentators (e.g., Harland, 1983; Pettit, 1975), who point to the unfalsifiability of its hypotheses. It is this criterion of demarcation that Karl Popper (1963) offers as a standard by which science may be separated from metaphysics. In contrast to Einstein's physics, which made bold conjectures that, if proven false, ultimately could lead to its rejection, Popper saw theories like astrology and Freudian psychology as risking very little. In each case ad hoc explanations always can be found to account for discrepancies in predictions. There simply is no way to challenge the validity of any single pronouncement because of the web-like system of auxiliary hypotheses that compensate for anomalous outcomes. Lévi-Strauss (1976) is clearly sensitive to the force of this argument, but denies its applicability to the social sciences, where he argues that even the most fundamental concepts have not been agreed upon. The way forward in this domain, he argues, is to see which hypothesis best fits the facts. Accordingly, if it can be shown that a given representation will increase the researcher's ability to explain a wider range of phenomena, then this Lévi-Strauss believes should be the mark of its scientific superiority. Yet, as D'Amico (1978) recognizes,

> If, in fact, there is no consensus on the basic concepts and if each hypothesis simply "cuts up" reality for its own purposes (creating it own "coherence") then hypotheses are incommensurate and no criteria, especially one of "economy," can be determined or allow for the decision Lévi-Strauss describes. Nor does it seem any better to hold out the hope, as Lévi-Strauss finally does, that at some "remote time" the hypotheses will be verified because the natural sciences will supply us with the "organic foundation" that the social sciences are in fact trying to study. This fails to grasp how a hypothesis is inseparable from a whole set of theoretical presuppositions and is a version of reductionism that seems to me to be the other side of Lévi-Strauss's commitment to a Platonic vision of sciences as coherent, rather than experimental. (p. 144)

What I have attempted to show through these criticisms is that Lévi-Strauss's structuralist "science" of mind is fundamentally misconceived. The immense variety of human cultures is a testament to the fact that social constructs cannot be reduced to the innate grammar of the individual mind. Not only is this argument to biology unconvincing, but the reduction of culture to a set of mental structures fails to capture the purpose and intention that is the essential stamp of human action. Lévi-Strauss's theory of the structured mind is a product of his endeavor to reformulate Durkheimian sociology. By equating the collective mind with the individual unconscious, Lévi-Strauss attempted to replace

Durkheim and Mauss's appeal to the emotions with an argument that bases society on the intellect. For Lévi-Strauss, culture becomes an epiphenomenon of nature, generated by the innate structure of the brain. While this fundamental hypothesis guides all his investigations, it also funds many of the "eccentric" arguments that have become the hallmark of structural anthropology. His continual efforts to reveal the immanent logic of the nature-culture dichotomy in all ethnographic reports only leads to the most contrived interpretations of native practices and thought. In particular it denies the emotional, aesthetic, and religious dimensions of life that emerge in the course of social history.

If, indeed, Lévi-Strauss could spin all cultures from the grammar of the structured mind, I am afraid it would make a very dull story. For what is distinctive about human beings is not some common cloth out of which we are all cut, but the culturally defined differences that constitute the variegated richness of life. This variety gives anthropology its point and defies Lévi-Strauss's efforts to capture the human mind with a pencil and paper.

CHAPTER 4
CHOMSKY'S THEORY OF MIND

Introduction

Transformational generative grammar is a theory about the syntactic, semantic, and phonetic structure of language. It is also a theory of linguistic competence, of how human beings produce, understand, and speak grammatically correct sentences. Its architect, Noam Chomsky, established this theoretical union to discredit a form of analysis that had developed in two separate disciplines. In linguistics he sought to challenge the work of the American descriptivist school (Devitt & Sterelny, 1987), while in psychology he attempted to undermine the basic principles of behaviorism. Both, he argues, relied upon superficial surface inquiries that failed to recognize the inner logic of language and human action. In place of their classification laws of observable regularities, Chomsky proposes a formal system of principles that will generate the rule-governed character of natural languages. While this "universal grammar" is not, as yet, explicitly known by linguists, the facts of our everyday command of language suggest that it is implicitly understood by all native speakers. Thus, according to Chomsky, linguistics ought to be reformulated as a branch of psychology that attempts to explain this basic competence through a scientific study of the human mind. As Chomsky (1965) describes this project,

> The problem for the linguist . . . is to determine . . . the underlying system of rules that have been mastered by the speaker-hearer . . . . Hence, in a technical sense, linguistic theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior. (p. 4)

The central thesis of Chomsky's (1972) work is that the rules of grammar and other systems of knowledge are not learned from experience but are a genetically inherited feature of the structured mind.

> We may think of grammar, represented somehow in the mind, as a system that specifies the phonetic, syntactic, and semantic properties of an infinite class of potential sentences. The child knows the language so determined by the grammar he has acquired. This grammar is a representation of his "intrinsic competence." In acquiring language, the child also develops "performance systems" for putting this knowledge to use (for example, production and perception strategies). So little is known about the general properties of performance systems that one can only speculate as to the basis for their development. My guess would be that, as in the case of grammars, a fixed, genetically determined system of some sort narrowly constrains the forms that they can assume. I would also speculate that other cognitive structures developed by humans might profitably be analyzed along similar lines. (p. 35)

In this chapter I shall examine Chomsky's defense of these claims. Of course, as one would expect in the thirty or so years since Chomsky introduced these ideas, his theory has undergone many revisions and changes. Rival paradigms have proliferated and acrimonious disputes have been waged even within Chomsky's research program. Yet despite these challenges, Chomsky's theory continues to dominate the discipline with a prospectus that has remained remarkably similar to that presented in his earliest writings. Most linguists today accept Chomsky's "rules and representations" model of grammar (Devitt & Sterelny, 1987) and believe that in charting the formal structures of language they are conducting a scientific investigation into the innate properties of the human mind.

Like Lévi-Strauss, Chomsky believes that the brain is an information processing device, manipulating mental states through syntatically defined laws. In addition to postulating such abstract rules, Chomsky (1988b) also has shown sympathy with the radical nativism of his one-time colleague Jerry Fodor and is prepared to add his voice to the claim that a number of concepts are also genetically inherited. While this position may be the natural consequence of the computational theory of mind, I will argue that it is philosophically untennable. In particular, I shall follow Sampson (1981) and Shina (1988) in rejecting the attempt to establish a scientific study of semantics, by arguing that meaning is a socio-historical phenomena that cannot be captured in the systematic manipulation of innate essences. Chomsky's central thesis that we have an unconscious knowledge of syntax will also be dismissed. I will argue that the methodological individualism of this argument leads to an asocial view of language that trivializes what is surely the central purpose of speech, that is, communication. Moreover, while Chomsky's studies of syntax have clearly demonstrated the hierarchical nature of linguistic structures, such a discovery does not necessarily imply that the brain supports an inner system of rules and representations. The fact that a fully explicit grammar may match the linguistic competence of native speakers does not commit us to the psychological reality of such mechanisms or the implicit biologism of Chomsky's thesis.

In the first part of this chapter I will describe the development of Chomsky's linguistic theory. Fodor's arguments for a "language of thought" will be introduced, and the question of innate semantic concepts will be addressed. In the second part I will discuss Chomsky's efforts to establish the structured mind thesis and evaluate the philosophical conclusions he draws from this position. Finally I shall show that Chomsky's "science of mind" is a version of the Kantian structuralism devised by Lévi-Strauss and thus can be rejected for essentially the same set of reasons presented in Chapter 3.

Chomsky's Theory

Chomsky published his first book, Syntactical Structures, in 1957. Although a short and relatively non-technical work developed out of his undergraduate teaching notes, it initiated what is now regarded as a revolution in linguistics. Prior to the book's publication, most linguists were engaged in the classification project of describing the phonetic and syntactic components of the world's various languages. Lees (1974) argues that Chomsky's transformation of this enterprise into a theory of generative grammar can be compared to the development of chemistry from alchemy. Descriptive linguistics, like alchemy, was a low-level science of measurement and categorization, a simple taxonomy of syntactic structures. In its place Chomsky initiated a search for an "explicit" grammar, a set of axiomatic rules which through combination would produce all and only the well-formed sentences of any language.

If Chomsky's revolution had only established linguistics as a mature science, his achievement would have been quite remarkable. But from its inception his theory harbored even grander aspirations. For in contrast to the traditional conception of linguistics as the study of language viewed as a social fact, Chomsky proposes to explain how all normal human beings acquire the capacity to produce grammatically correct sentences. As I argued in Chapter 3, Saussure thought that such questions concern parole rather than langue and related to the learning experiences of each individual. In contrast, Chomsky collapsed these two domains into a single inquiry. By arguing that human beings are born with a biologically programmed mental faculty capable of generating syntactically correct sentences, Chomsky claims that the study of grammar is the study of linguistic competence. Through this controversial union, Chomsky turns linguists into psychologists and elevates the search for syntactical laws into a quest for the innate mechanisms of the structured mind.

That there should be an intimate connection between language and the nature of mind has been a popular conviction throughout the history of Western thought. Both Descartes and Rousseau distinguished human beings from the animal kingdom not on the basis of unique intellectual powers, but because of our command of language. Even the recent work with apes (such as Washoe) that demonstrates how lower primates can communicate symbolically does not invalidate this criterion. For what is distinctive about human language, in Chomsky's account, is our ability to generate an infinite set of sentences from the limited recursive rules of grammar. It is through this syntactic capacity that people display a qualitatively different "creative" power to that of other animals. Indeed, as Chomsky (1988b) points out, when apes are taught a human sign language, the advances they make only consist in the simple addition or repetition of symbols, rather than any creative articulation of terms.

This "creative" aspect of language is the kernel of Chomsky's thesis. He argues that empiricist theories simply cannot account for the spectacular growth in the child's linguistic proficiency, since associationist laws of learning fail to capture how individuals acquire the capacity to generate an infinite number of grammatically correct sentences from the poverty of their experience. Moreover, he considers the whole endeavor of describing a subject's actions through statements about bodily conditions to be thoroughly misguided. For Chomsky even the term "behavioral science" implies a fundamental confusion between evidence and subject matter, since it suggests that psychology can be reduced to a set of observations, as if, by analogy, physics is merely the study of reading instruments

(Searle, 1974, p. 2). In short, to become a truly scientific study, linguistics must adopt the mentalistic stance of cognitivism and search for the system of rules that govern our grammatical abilities.

In place of the behaviorist conception of language learning, Chomsky proposes a structured model of mind. He believes that human beings are biologically endowed with certain species-specific capacities from which the grammatical rules of all natural languages may be derived. In place of learning and development, Chomsky thus explains the spectacular feat of language acquisition through the concepts of growth and maturation. Indeed, extending the range of his argument, Chomsky (1980a) even contends "it is rather doubtful in fact, that there is much in the natural world that falls under learning" (p. 14). What psychology traditionally viewed as learning theory ought to be reformulated as "the study of tasks and problems for which we have no special design, which are at the borders of cognitive capacity or beyond, and are thus guaranteed to tell us very little about the nature of the organism" (p. 14).

For the philosopher, talk of an inherited knowledge of language reawakens the traditional debate between empiricism and rationalism. So when Chomsky boldly admits his "new rationalism" to be fully in accord with Descartes's concept of innate ideas, important philosophical questions are raised, questions which for many had been laid to rest by the rise of modern empiricism and the Western scientific tradition. In fact, Chomsky (1966) takes great pains to ally himself with Descartes and other rationalist philosophers of the 17th century. As Chomsky (1966) points out, Descartes also saw language as the distinguishing mark of humanity and believed that scientific explanations of behavior--while appropriate for animals--could not capture the nature of the human mind. In this respect, at least, Chomsky (1972) believes that Descartes and the Port Royal linguists (the first movement to study grammar as the product of the mind) were far closer to explaining the creativity of the language user than their 20th century counterparts.

While there are numerous similarities between Chomsky's theory and the analysis of language provided by the Port Royal grammarians (including the use of suface and deep structures, transformation rules, and the decomposition of sentences into phrases), it is not clear that both are committed to the same epistimology. At times it appears that Chomsky is determined to be a standard bearer for Descartes and score philosophical points against his "Ivy League" rivals by re-staging this traditional debate. In fact, I shall argue that a careful look at Chomsky's thesis reveals that his arguments are closer to Kant's theory to than Descartes's rational psychology of mind.

Chomsky's view of human nature comes into sharper focus when his theory of mind is compared with the ethical account of the subject implicit in his more popular political writings. Although it may seem tenuous to suggest any continuity between the social issues that Chomsky has championed and his highly technical work in linguistics, the two do in fact share a common concern. Indeed, Chomsky even credits his sympathy with the political views of Zellig Harris as the main reason for his interest in linguistics as an area of undergraduate study (Hymes, 1974). This is the desire to liberate individuals from the "nihilism" of science, to establish the subject's dignity, and, against all efforts, whether in the guise of an insensitive political philosophy or an inappropriate psychological model (like behaviorism) to resist controlling and classifying people on statistical rather than a humanitarian basis. If people were really as these psychological theories and political agencies characterize them--malleable impressions of environmental experiences--Chomsky thinks that our lives would be extremely impoverished. It is only because men and women have been programmed genetically with rich biological capacities that creative action and free-will is possible. Insofar as Chomsky (1988b) campaigns for a recognition of this essential nature in both the linguistic and political fields, he claims the title of a libertarian socialist and sees himself as a spokesman forced to practice anarchistic rebellion against a government that has lost sight of the individual.

While Chomsky (1987) represents himself as a modern-day follower of Rousseau, others have compared him to Bertrand Russell and great Jewish thinkers like Marx, Freud, and Einstein. Otero (1988), for example, views such individuals are "genetic hybrids," geniuses who are also biologically endowed with superior ethical understanding. On his account, Chomsky stands out as a contemporary prophet whose moral wisdom can point toward a just and decent society. Alternatively, less biologically oriented critics may find an explanation for Chomsky's theory of value in the extraordinarily erudite family within which he was raised. From this rich intellectual setting, Chomsky developed the virtues that many great Jewish thinkers before him have shared: a faith in justice, a love of knowledge, and a passionate belief in free thought and self-expression.

Before any of these related topics can be explored, it is necessary to provide a brief exegesis of Chomsky's linguistic theory. The review I shall present will be relatively non-technical, yet I hope it will be sufficient for the exploration of the philosophical and psychological questions the thesis raises. It should be recognized, however, that Chomsky's theory is extremely complex and consists of a rigorous application of autonoma theory and the mathematics of recursive functions to the interpretation of natural languages. It is remarkable that among Chomsky's many other achievements, he has made original contributions to these areas of inquiry.

Descriptive Linguistics

Linguistics in the United States, from the beginning of the 20th century until the 1950s, was conceived as the task of recording and describing as many native American languages as possible, prior to what seemed their inevitable extinction (Sampson, 1980a). Because of this imperative, attention turned to the methodology of field research and the techniques to be employed in the description of previously unknown languages. In particular, the problem of scientific rigor was stressed and attention was focused on the production of manuals that would ensure the objective translation of radically different languages.

Perhaps the most famous investigator of this era was Franz Boas (Lyons, 1977). From his study of indigenous American societies, Boas concluded that the range and variety of human speech was far greater than might be supposed from an analysis of European languages. Not all of the traditional syntactic forms are necessarily present in every tongue. Some tribes, the Kwakiutl, for example, do not distinguish between singular and plural, whereas the Hopi and various Innuit societies fail to employ past and present tenses consistently (Lyons, 1977). Such findings convinced Boas that all languages had a unique organization and that the proper task of linguistics was to describe these syntactic systems in terms of the basic grammatical categories. Of course this orientation was not unique to North American linguists; I argued that a similar theoretical commitment is found both explicitly in Troubetskoy's phonological studies and implicitly in Saussure's concept of langue.

Following Boas, American linguistics branched in two directions, each camp being guided by a prominent theoretician. Under the influence of Edward Sapir (Cooper, 1973), the relationship between language, culture, and the diversity of conceptual schemes was investigated. Sapir's fieldwork inspired a humanitarian turn that was to forge a close link between linguistics and anthropology. In contrast, Leonard Bloomfield (1933) attempted to establish linguistics as an autonomous scientific discipline. Unlike Sapir, whose writings were insightful and full of vivid analogies, Bloomfield concentrated soley on those areas that could be described with the rigor and precision of mathematical analysis.

Influenced by positivist philosophy, Bloomfield (1933) explicitly adopts the tenets of behavioral psychology as the scientific standard for linguistic explanations. In fact, his commitment to behaviorism is so strong that he even claims it to be possible to predict the words that a certain stimulus would cause a man to say, given "the exact structure of his body at the moment" (p. 33). Yet since he recognizes that such descriptions are beyond the present limits of analysis, Bloomfield says very little about the semantic component of language. The prevailing attitude of the descriptivist school is that although the purpose of speech is to express meaning, the job of the linguist is limited to the examination of language as an instrument. The uses to which language is put are a secondary and less important concern. Perhaps the most ambitious attempt to complete this program was provided by Zellig Harris (1951) in his Methods in Structural Linguistics. As I have mentioned, Harris was Chomsky's teacher and later his co-worker. Moreover, it was Harris who both suggested and helped construct the logical formulas employed by Chomsky in his initial theory of transformational grammar.

Chomsky is indebted to both of these avenues of American linguistics. From Sapir he learned a humanistic attitude and a sensitivity toward the role of language in social life, while from Harris, and the Bloomfield school in general, he acquired the technical apparatus to formulate his highly abstract theory. Moreover, since throughout his career Chomsky has continued to assert the primacy of syntax within linguistics, it is fair to say that in a broad philosophical sense he still writes from within the descriptivist tradition.

Theories of Linguistic Structure

To repeat Chomsky's criteria, a grammar is a set of rules that can generate all and only the sentences in a given language. The test for the adequacy of an hypothesized grammar is the extent to which it matches a native speaker's intuitions about language. While there may be occasions when speakers disagree about whether particular utterances are syntactically correct, providing the main body of sentences produced by the grammar are accepted, such differences of opinion can be seen as problems of individual performance.

Since any mathematical model of a grammar must generate an infinite number of such well-formed sentences, Chomsky (1959) recognizes that human linguistic competence can be described only through the application of recursively defined formulas. Further, Chomsky adds, such rules must also exhibit the appropriate grammatical structure of all the sentences they produce. One attempt to match these criteria arose from the development of information theory. "Finite state grammars" were constructed to replicate sentence formation through sets of Markov algorithms, procedures for the syntagmatic selection of words within a sentence. While this probabilistic analysis of surface strings proved successful in predicting certain word associations, it does not match the speaker's conception of sentence construction, and as Chomsky (1965) has shown formally, it also fails to account for the context dependency of terms within certain phrases. In particular, any sentence of the form "a + (b + (c + . . . + x) + y) + z," where the outer terms are nested together through some rule of compatibility or dependency; "a" and "z", "b" and "y", and so on (so called mirror image properties), cannot be constructed by this theory, no matter how convoluted its explanations become (Lyons, 1970). In short, the word by word model of sentence production fails to match either of Chomsky's criteria for an adequate grammar.

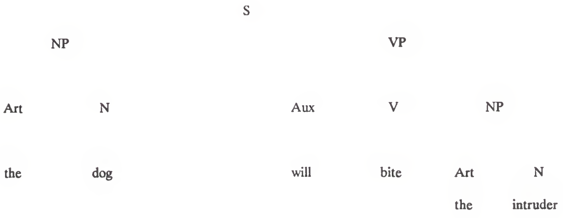
By the time of Zellig Harris, the prevailing conception of syntactic description was through "phrase structure grammars" (Lyons, 1977). Rather like the classical study of grammar in which language is decomposed into the various parts of speech, this was an attempt to describe the structure of sentences in terms of their subjects and predicates. A set of formulas, or phrase structure rules (PS) were postulated which through combination could yield grammatical sentences. In what follows I will offer a simplified example:

1. S -> NP + VP
2. NP -> Art + N
3. VP -> Aux + V + NP
4. Art -> (a, the, . . .)
5. N -> (man, dog, intruder, . . .)
6. V -> (bite, kick, . . .)
7. Aux -> (will, may, . . .)

Here S means sentence, NP = noun phrase, VP = verb phrase, N = noun, V = verb, Art = article, Aux = auxillary verb, and the symbol "->" is the instruction to rewrite the left hand side with the right. Given these PS rules, a sentence can be derived in the following way:

S	
NP + VP	rule 1
Art + N + VP	rule 2
Art + N + Aux + V + NP	rule 3
Art + N + Aux + V + Art + N	rule 2
the + dog + will + bite + the + intruder	rules 4, 5, 6, and 7

More intuitively, this derivation by PS rules can be illustrated graphically by the tree diagram



The structural description that the diagram provides (or, alternatively, the set of lines in the derivation) is called the phrase maker (PM) of the sentence. A string is any line constructed in accord with PS rules, while the last line, a "terminal string," must be a grammatical sentence. The subject of the sentence is that NP which is directly dominated by S, and the object is the NP which is determined by the VP. The rudimentary grammar of these seven rules then can be enriched by the introduction of other laws. For example,

8. VP -> V transitive + N
V intransitive
9. V -> V + S/in the context NP singular

Rule 8 represents the fact that a VP can be formed from a transitive verb together with an object noun, or simply an intransitive verb; whereas Rule 9 shows that verbs must end in "s" when the subject noun is singular. Of course, many more rules will be required if this grammar is to match that of the English language.

While it may be formally possible to construct a phrase structure grammar that will generate all and only the well-formed sentences of a natural language, Chomsky cites two reasons for its inappropriateness. First, methodologically, such grammars are inherently complex because they are restricted to "lower order" rules. Invoking the standard of simplicity as a criterion of a theory's superiority, Chomsky (1957) argues,

> There are certain sentences . . . simple declarative active sentences . . . that can be generated in a quite natural way. There are others (e.g. passives) . . . that cannot be generated in an economic and natural way . . . but that are systematically related to sentences of simpler structure. Transformations that are constructed to express this relation can thus materially simplify the grammar when used to generate more complex sentences and their structural descriptions from already generated simpler ones. (p. 129)

Chomsky's (1965) second criticism of phrase structure grammars is derived from his attempt to establish a theory of language that is also a psychological description of a speaker's linguistic abilities.

> A weaker, but pefectly sufficient demonstration of inadequacy would be to show that the theory (i.e., phrase structure grammar) can apply only clumsily; that is, to show that any grammar that can be constructed in terms of this theory will be extremely complex, ad hoc and unrevealing. (p. 34)

Although Chomsky is somewhat vague about this criterion of "revealingness," it is clear that he aims to establish a standard for judging grammatical relationships based upon the intuitions of native speakers. A superior grammar is one that reflects the similarities, differences, and ambiguities that an individual experiences in language.

Chomsky (1965) supports his argument with three examples that illustrate the limitations of phrase structure grammars. First he argues that such rules are unable to describe the syntactic ambiguities in a sentence like "Feeding lions can be dangerous." Since this statement has more than one meaning, one would expect that two or more syntactical derivations could be provided corresponding to each interpretation. Second, although two sentences can appear superficially similar, they may function quite differently. Consider for instance,

(a) John is easy to please.
(b) John is eager to please.

While these sentences are produced by identical PMs, they nonetheless exhibit distinct structures, as the noun phrase of each reveals.

(a') John's easiness to please.
(b') John's eagerness to please.

In each case, "John" plays a different role, first as the object of phrase (a) and then as the subject of (b). This can be seen more clearly when the name of the individual who is trying to please John is introduced, as in "Mary finds that John is easy to please," and the person whom John wishes to please, in for instance "John is eager to please Jane."

Third, just as the previous example shows how surface similarities hide underlying differences, so, Chomsky argues, apparently distinct sentences can conceal inner identities. That is, one expects a grammar to exhibit the interrelationship of the following two sentences:

(c) He looked up the number.
(d) He looked the number up.

Indeed, a suitable grammar should reveal all the sentences, such as (c) and (d), which differ in surface character while sharing the same meaning.

In each of these examples, the produced PMs fail to capture the intuitive relations experienced by native speakers. In order to capture such connections Chomsky suggests a qualitatively different kind of rule-governed system and introduces a set of "transformational" formulas that serve to map one PM into another. For instance, in order to change the sentence "The boy hit the girl" into its passive form "The girl was hit by the boy," he proposes the following rule (Cooper, 1973):

10. NP_1 - Aux - V - NP_2 -> NP_2 - Aux - (be + en) - V - by - NP_1,

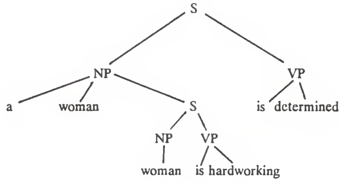
where (be + en) is a sub-rule for manufacturing the passive tense using the relevant word endings. Other rules can also be constructed (Cooper, 1973):

11. (NP_1 - V - NP_3) and (NP_2 - V - NP_3) -> NP_1 - and - NP_2 - V - NP_3
12. NP_1 - V - Particle - NP_2 -> NP_1 - V - NP_2 - Particle

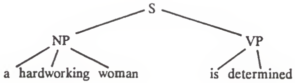
Transformation rules are quite different from their PS counterparts. The latter only allow the replacement of a single character within a string and strictly maintain the order of its constituent parts. In contrast, transformational rules permit a wider variety of substitutions; whole or part strings may be treated as variables, and any line within a PM may be replaced. As Katz (1966) explains,

> transformational rules thus differ from phrase structure rules in that, while a phrase structure rule can only make use of information contained in the linear context of the symbol to be rewritten, a transformational rule can use any information in a phrase maker to which it applies. (p. 144)

Chomsky's generative grammar is composed of both PS rules, adapted to meet his needs, and transformational laws like those illustrated in rules 10, 11, and 12. Unlike his predecessors, Chomsky no longer demands that PMs express sentences. Indeed, in this new interpretation, the majority of PMs are quite removed from the completed sentence. Strings derived by PS rules alone are called "underlying strings" and are represented by an "underlying phrase marker." At this level we view the "deep structure" of a sentence. The "surface structure" is associated with the final derived PM, which is produced through the repeated applications of various transformational rules. So, for example, the underlying PM of the sentence "A determined woman is hardworking" has a deep structure that looks something like this:



After the application of transformational rules, the surface structure is revealed in the derived phrase marker:



Here, then, is the essence of Chomsky's (1965) argument. Surface structures only provide a small amount of information. The underlying or deep structure reveals the essential elements necessary to understanding a sentence. Further, Chomsky claims this structural analysis meets the standard of revealingness, accurately matching the relationships in the native speaker's linguistic intuitions.

Returning to Chomsky's three examples, in the first case the ambiguity is not generated by the various meanings of a single work (e.g., "Alsatians eat dog food"), but rather through the syntactic structure of such sentences. In the case of "Feeding lions can be dangerous," Chomsky maintains that there are two different underlying strings that can be converted into this sentence by applying different transformation rules. ("It is dangerous to feed lions" and "While it is feeding, a lion can be dangerous.") In the second example, involving the sentences "John is easy to please" and "John is eager to please," while each PM shares an identical surface structure, the difference in their syntax derives from the fact that they are produced from distinct strings. Finally, transformational rules enable us to generate a whole family of sentences out of a single PM. For instance, the sentence "He looked the number up" can be changed into "He looked up the number" by the application of Rule 10.

The essential point that these examples illustrate is that sentences produced by the rules of a phrase-structure grammar alone fail to capture the meanings experienced by native speakers. A person's linguistic competence is revealed more accurately through a system that generates sentences by combining underlying PMs with transformation rules. It may be the case that such structures are highly abstract and entertain only a minimal connection with the actual sentence spoken, even containing elements that receive no phonic representation, but to the extent that they explain the ambiguities, similarities, and differences observed in language, they are more "revealing" and less complex than the analysis of grammar offered by phrase structure rules.

Models of Grammar

A total theory of language, its sentence production, meaning, and speech, is called grammar. And a grammar for Chomsky (1965), as we have seen, is also a model of the human mind. Over the years Chomsky has made several attempts to formulate an adequate grammar by hypothesizing the respective roles played by syntax, semantics, and phonology within language. His first effort, the Standard Theory, offered an elegant solution to this problem drawn from his distinction between deep and surface structures. In essence his idea was that meaning is taken from the "thematic" relations implicit in the underlying PM, whereas the sound of a sentence is read off from the derived terminal string. According to this model, grammar has four independent components, shown in Figure 4.1.

The base component generates the deep structure of a sentence from a set of PS rules and a stock of words stored in the lexicon. Terms are listed along with their syntactic categories (noun, verb, etc.), phonological profile (nasal, grave, etc.), and basic semantic features (animate, human, etc.). Once selected and combined, these words--like the molecular propositions of Wittgenstein's (1922/1966) Tractatus--become part of a composite structure that must be analyzed for meaning by the semantic component. In contrast, phonological rules clearly operate at the level of surface structure, for while the phonetic information contained in the lexicon and preserved by the transformational component, a number of modifications must be introduced to amalgamate the individual sounds within a sentence. As Chomsky (1965) summarizes,

> both the phonological and semantic components are therefore purely interpretive. Each utilizes information provided by the syntactic component concerning formatines, their inherent properties, and their interrelations in a given sentence. Consequently, the syntactic component of a grammar must specify, for each sentence, a deep structure that determines its semantic interpretation and a surface structure that determines its phonetic interpretation. (p. 16)

Throughout the 30 or so years during which Chomsky has developed his views on language and mind, one of his central concerns has been to reject any notion of a general intelligence. Each component within his model of grammar is defined in terms of a domain specific, autonomous task, for which the brain has been innately "hardwired." As Fodor (1983) recognizes, this modern restatement of faculty psychology, popularly known as the "modularity thesis," has become the stock-in-trade of "top-down" cognitive scientists and artificial intelligence researchers. By breaking cognitive processes like sentence parsing into a number of discrete "computationally shallow" mechanisms, these theorists aim to model the human mind through sets of computer programs. This research program then is complemented by the "bottom-up" efforts of neurophysiologists who endeavor to complete this contemporary version of Gall's phrenology by identifying the neural architecture of the brain associated with each of these individuated functions. As we will see in Chapter 5, the claim that the mind is organized into vertically related modular units contradicts Piaget's belief that the same functional mechanism underlies all action.

Chomsky's Standard Theory thus is an attempt to identify the basic modular subsystems of a grammar. As the schema shown in Figure 4.1 illustrates, syntax plays the central role of generating the deep and surface structures from which, respectively, meaning and sound are read. With this fundamental commitment to the autonomy of syntax, Chomsky continued his efforts to identify transformation rules, while encouraging his colleagues to describe the remaining components of the grammar. Extending the work of Jakobson, Chomsky combined with Morris Halle (1968) to explain

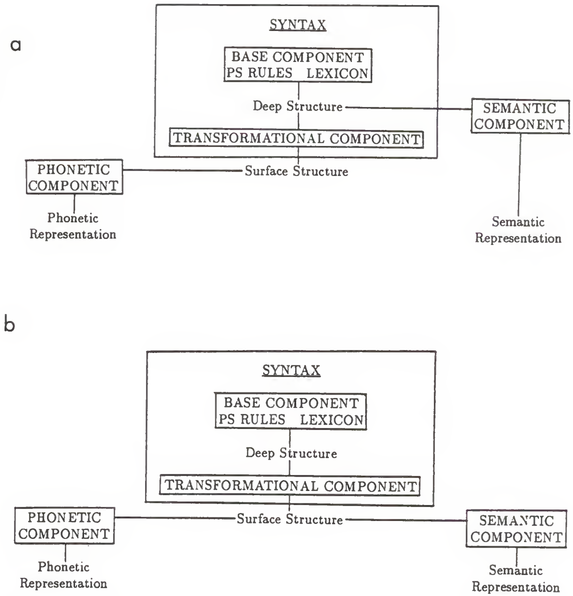


Figure 4.1. Chomsky's Models of Grammar
(a) Standard Theory
(b) Trace Theory

the phonological system, while Fodor and Katz (1964) provided an account of semantics. Their solution to the problem of meaning within language incorporated two phases of interpretation. First, they argued that the lexicon must be regarded not just as a list, but as a dictionary of words, each stored with a definitive meaning determined by a matrix of basic concepts. The term "bachelor," for instance, is constructed from "semantic primes" in exactly the same manner that a chemical compound is formed by the relationships between its constituent atoms. So, as Katz (1966) explains, one of the several entries for this word should read "(i) (Physical object), (living), (human), (male), (adult), (never married)" (p. 155). Second, in order to grasp the overall sense of a sentence, a set of rules must interpret the meaning generated by the composition of these molecular terms in deep structure.

One consequence of this semantic theory is that a richer concept of the lexicon must be admitted into the base component. As Steinberg (1981) explains in a footnote,

> whether Chomsky would actually include the semantic features along with lexical items in Deep Structure is a matter of conjecture. His earlier work is not clear on just what are or are not semantic features, e.g., he calls "Animate" and "Humanness" syntactic features. McCawley (1968) criticizes that view. Certainly it would be untenable for Chomsky to hold that features like "Marriage" are syntactic (a spinster vs. bachelor distinction). If so, the question arises as to when such features are included along with the lexical item. Either such features accompany lexical insertion when all lexical items are inserted into the Deep Structure, or such features are added as one of the first semantic rules to apply, i.e., to return to the lexicon to recover the semantic features (this was the position of Katz & Fodor, 1963). (p. 47)

In fact, while Chomsky (1965) admits that the lexicon may contain universal semantic representations (see his footnote 15, p. 226), he remains adamant that such semantic features can play no role in the choice of syntactic or phonetic rules.

One important consequence of the Standard Theory is that meaning must be preserved through transformations. If this were not the case, sounds, which are derived by the phonological component from the surface structure, would not match the meaning of a sentence given in its deep structure. This is an important point that is recognized by both Piaget and Lévi-Strauss in their analysis of mind, for any structuralist theory designed to model psychological mechanisms with mathematical rules must establish formulas that preserve meaning within a system of transformations. Yet, as the following example shows, Chomsky soon found that this principle was violated by a number of tranformation laws.

Consider the sentence, "Many people don't eat meat." By Rule 10, this can be changed into the passive form, "Meat isn't eaten by many people." There is, however, a distinct difference in the meaning of these two sentences, for while the first is perfectly compatible with the fact that many people do eat meat, the second appears to rule out this possibility. In short, the transposition of "many" and "not" proved to be semantically significant. This, and other examples, contradict Chomsky's criterion of meaning invariance under transformation and therefore bring into question his belief in the modularity of syntax.

Chomsky's first attempt to overcome this problem, the "Extended Standard Theory," recast the semantic component to operate on both deep and surface structures. The aim was to compensate for the distorting effect of transformational rules. This move accommodated the change of scope produced by the switching of quantities within a sentence, but the new formulas it demanded proved both complicated and inelegant and thus undermined Chomsky's ideal of scientific simplicity. Indeed, as a group of Chomsky's former students were quick to point out, any model of grammar that employs the syntactic component at two different levels must be implicitly un-economical (Newmeyer, 1980).

Led by George Lakoff, this rival group attempted to stage something of a counter revolution by reversing the roles played by syntax and semantics within Chomsky's theory. Briefly, they argued that all syntactic categories (in fact sentence formation in general) are dependent upon semantic information. Even a "noun," for instance, expresses the concept of "thinghood." According to these authors, syntax is not independent of semantics, but should be viewed as a byproduct generated by the speaker's efforts to express meaning. As Lakoff (1980) explains,

> what we found was that meaning and use (communicative function) effected virtually every rule of syntax. In order to keep the central modularity assumption--the independence of syntax--Chomsky has progressively redefined and narrowed the domain of syntax so that rules that were traditionally part of syntax . . . were redefined as being in . . . a different module. (p. 23)

A theory of generative semantics was thus proposed in which the words and syntactic rules of Chomsky's base component were replaced by a model of grammar founded upon ideas. Language, it is argued, can be reduced to a series of propositional forms that express a causal relationship between the subject and predicate of a statement. Since each proposition is taken to represent the thought that stands behind a sentence, this new semantic deep structure does not contain lexical terms, but rather abstract entities such as "thing," "state," and "action." It was further claimed that since this semantic structure is common to all human beings, the decomposition of sentences into such ideas can be used as a method for translating exact meanings between different languages, a thesis that became known as "The Universal Base Hypothesis" (Lyons, 1977, pp. 83-103). As Figure 4.2 illustrates, the abstract components of the semantic structure are encoded with the lexical terms learned within a particular language and transformed through syntactical laws into the surface structure of a sentence. Then, as with Chomsky's model, the grammar is completed by a system of phonological rules.

Despite the differences between Chomsky and his followers, on closer inspection both theories can be seen to share a number of common assumptions. In particular, each employ transformation rules and incorporate essentially similar sets of semantic and phonological primes. Moreover, when it is recognized that both models attempt to phrase a theory of competence rather than account for actual linguistic acts, the question of the priority of syntax or semantics becomes less of an issue, for neither position claims that a speaker constructs a semantic proposition and then searches for a syntactical conduit for the idea (or vice versa). Clearly our psychological structures must work in concert. In this respect, a theory of grammar parallels Kant's atemporal analysis of the understanding: Categories and sensations, although separate as form and content, go "hand in hand" within thought. Where the two theories diverge is on the more technical issue of whether semantic considerations motivate syntactic rules. For many, a generative semantic component presents a more attractive option, since it promises universal criteria for the identity of meaning. However, through time, the abstractness and complexity of structures demanded by this formulation, along with the difficulty of identifying a set of acceptable semantic primes, tempered the enthusiasm of its original supporters. The theory's major successes, as one might expect, centered on the solution of technical problems like "synonymy" and "analaticity"

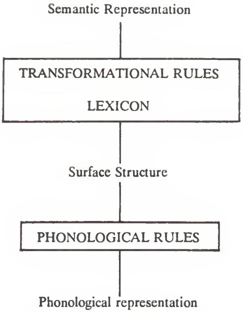


Figure 4.2. The Generative Semantics Model of Grammar

(Cooper, 1973). In each case, the semantic representation provides a standard by which different meanings can be compared. Yet, perhaps the most important function of semantics--the relationship between language and reality--remains vague. For in reducing sentences to semantic primes, meaning is defined in terms of unanalyzable and unexplained basic concepts (Devitt & Sterelny, 1987, p. 102).

Throughout the debate over the primacy of syntax, Chomsky (1975) has maintained his initial conviction that the semantic component of grammar is an interpretive mechanism. However, to simplify the complex set of relationships required by the Extended Standard Theory, he proposed that meaning can be described solely from "a somewhat enriched notion of surface structure" (p. 82). In this respect, Chomsky's most recent formulation of grammar--"Trace Theory"--emulates generative semantics in recognizing that meaning can be derived from just one level, but it differs insomuch as this determining role is seen to operate on surface structures.

In order to explain this new capacity, Chomsky argued that transformation rules must preserve the syntactic relationships established by the underlying PMs. Such "traces" will then exist implicitly in the surface structure of a sentence. For example, Rule 10 meets this criterion, since the "by" term marks the subject of the original verb. In contrast, the transformation rule that produced the syntactically ambiguous "Feeding lions can be dangerous" does not preserve deep structure, so according to this new theory it must be redefined.

Since a theory of grammar represents the total mechanism of linguistic competence, it should, therefore, coordinate and explain every aspect of a speaker's ability. With this stipulation in mind, Trace Theory (Figure 4.2) receives important support over previous formulations of grammar from the relationship it establishes between phonology and semantics. Because the surface structure determines how a sentence should be enunciated, according to the earlier theories, there would be no difference in the pronunciation of "Feeding lions can be dangerous," despite its two distinct meanings. Yet, if a speaker means to say that it is dangerous to feed lions, the word "feeding" will be stressed, whereas for the second interpretation, "lions" is emphasized. Trace Theory is the only model that provides a surface structure of sufficient complexity to achieve this discrimination.

Throughout each formulation of the grammatical model, Chomsky has retained his theoretical commitment to the primacy of syntax over semantics (Lyons, 1977). Even the changing emphasis from the complexity of deep to surface structures should not be misunderstood as diminishing the role of underlying phrasemakers, for these are still generative in Trace Theory in exactly the same sense as they were in the Standard Theory. Further, it should be observed that the semantic component remains derivative, albeit in a quite different location.

It is worth noting that unlike the theorists behind the Generative Semantics movement, Chomsky has never subscribed to the Universal Base Hypothesis. For while he recognizes that all languages can be described through a combination of "substantive" universals--the phonetic, syntactic, and semantic categories like "|p|," "noun," and "male" that make up the general theory of grammar--he believes it is impossible to identify a common set of such terms from the entire spectrum of human speech. Like Jakobson, Chomsky believes that the surface similarities of language are produced by deeper "formal" universals, which, in a similar manner to the distinctive features of the phonetic system, exist in the psychological construction of the brain. It is at this level that Chomsky advances his theory of the structured mind. However, while Chomsky, as a linguist, chooses methodological reasons to investigate the syntactic structure of thought, this should not be taken to indicate that he is unsympathetic to the belief in innate semantic concepts. In fact Chomsky (1988a) seems to endorse Fodor's (1975) arguments and even speculates that quite specific ideas are genetically inherited.

> There is, in fact--just to give one example--a recent issue of a linguistics journal that has a long detailed article trying to give the meaning of the word "climb." And it is very complicated. But every child learns it perfectly right away. Now that can only mean one thing. Namely, human nature gives us the concept "climb" for free. That is, the concept "climb" is just part of the way in which we are able to interpret experience available to us before we even have the experience. That is probably true for most concepts that have words for them in language. This is the way we learn language. We simply learn the label that goes with the preexisting concept. So in other words, it is as if the child, prior to any experience, has a long list of concepts like "climb," and then the child is looking at the world to figure out which sound goes with the concept. We know that the child figures it out with only a very small number of presentations of the sound. (pp. 190-191)

This tangle of claims can be clarified somewhat by recognizing the relationship between language and thought hypothesized in the modular theory of mind.

The Modularity Thesis

Chomsky (1980a) believes that the mind, like the body, may be viewed as a network of interacting subsystems. Just as the heart and liver have evolved their own specific "architecture," so Chomsky conjectures that the various components of the mind, while interrelated, are functionally autonomous. It is only this degree of specialization that can explain the speed and range of human thought. The language faculty, which itself is just one unit within a more general "economy" of cognitive systems, even has its own specialized subcomponents that administer the various tasks of sentence production. Other "mental organs" may exist to control our memory, perceptions, categorization skills, and even face recognition abilities. However, at the base, each of these modules must be able to communicate information or rather meaning through a general "conceptual system." As Garfield (1989) summarizes the thesis,

> the mind comprises not only central systems that can take advantage of any and all information at their disposal and each of whose representations are globally sensitive to all the other representational states and processes of the organism, but also a number of modular systems dedicated to sensory and linguistic input analysis and to linguistic and motor output. The operation of these systems is mandatory, domain specific, and fast; they are informationally encapsulated; they yield only a specific, relatively shallow level of representation to central processes; and they are realized in specific, dedicated neural architectures. Central systems, in contrast, are slower and more subject to voluntary control in their operation, are unencapsulated, are typically neurally scattered, and operate with a semantically much richer set of representations. Modular processes are blind; central processes deliberate. (p. 7)

While Chomsky views the syntactic module as a highly specialized computational device, he believes that the conceptual system is somewhat more primitive. Lacking the general and recursive rules of grammar, the basic semantic essences interact according to a rudimentary logic that permits only the most elementary forms of reasoning. This model of a pre-linguistic domain of thought enhanced by a powerful computational system leads Chomsky (1980a) to suggest the interesting hypothesis that human beings differ from other species on account of their syntactic abilities.

> One might speculate that higher apes, which apparently lack the capacity to develop even the rudiments of the computational structure of human language, nevertheless may command parts of the conceptual structure just discussed and thus be capable of elementary forms of symbolic function or symbolic communication while entirely lacking the human language faculty. Possible support for such a view derives from work indicating that humans with severe language deficit--perhaps literal destruction of the language faculty--can acquire systems similar to those that have been taught to apes, as if, to put it very loosely, apes were in this regard like humans without the language faculty. (p. 57)

The central tenet of Chomsky's view of mind is thus the initial separation of syntax from semantics. On this account, language learning is a process of linking these two systems and "setting" the internal structures of the mind--its rules and representations--to the external codes and concepts embedded in social life. Linguistic communication, as Katz (1966) explains,

> consists in the production of some external, publicly observable, acoustic phenomenon whose phonetic and syntactic structure encodes a speaker's inner, private thoughts and ideas and the decoding of the phonetic and syntactic structure exhibited in such a physical phenomenon by other speakers in the form of inner private experience of the same thoughts or ideas. (p. 98)

Language learning thus involves a number of separate tasks. The lexicon must be constructed by tagging the concepts of thought with publically employed words, the correct rules of syntax set in accordance with the structure of the natural language, and vocal forms must be aligned with the accepted sounds adopted by the speech community.

While Chomsky (1988b) clearly accepts the existence of innate concepts and has often conjectured on the nature of the conceptual system, he offers no formal characterization of the structure of thought. Content to pursue his interest in the computational system, Chomsky typically leaves questions about semantics to his co-workers, foremost of whom is his one-time colleague Jerry Fodor. Although the primary focus of this chapter is Chomsky's thesis of the structured mind, it is important to consider the view of thought generated by the modularity hypothesis. Accordingly, I shall briefly discuss Fodor's (1975) arguments for the semantic component, which lead to the postulation of a language of thought and an even more radical nativism than that presented by Chomsky.

The relationship between thought and language described by Katz (1966) may be regarded as a modern statement of a position that can be traced back to Saint Augustine. Wittgenstein (1955), at the beginning of the Philosophical Investigations, attacks this theory and its focus on the individual as the source of meaning. In rejecting the influence of language in the construction of mind, this outlook also stands in direct contrast to Vygotsky's (1934/1962) influential thesis on the social origin of mental functions. Yet it is the view that Fodor (1975) wishes to establish as a necessary consequence of the cognitive theory of mind. His argument is founded upon two assumptions. First, when the mind is modelled on a computer, natural languages can be compared to software programs. Continuing the analogy, Fodor claims that the brain must be furnished with a machine code or language of thought in which such instructions may be written. Yet unlike a computer, Fodor rejects any attempt to physically discharge the intentional content of these mental states into a large number of qualitatively blind operations performed, as Dennett (1978) puts it, by an army of blind homunculi. The language of thought--"mentalese"--consists of a system of mental representations or "propositional attitudes" that causally interact to generate other states of belief in a lawful manner. Of course it is not the content of an idea that affects other thoughts; the concept of "redness" cannot cause a person to think of something else. According to the computational theory of mind, the human brain, like the digital computer, must process symbols by virtue of their structure rather than their meaning. Fodor's (1986) novel solution to the problem of reconciling an intentional psychology with the demands of physicalism is thus to explain causal efficacy through the syntactic form of a concept's host.

> Here, in barest outline, is how the new story is supposed to go: You connect the causal properties of a symbol with its semantic properties via its syntax. The syntax of a symbol is one of its higher-order physical properties. To a metaphorical first approximation, we can think of the syntactic structure of a symbol as an abstract feature of its shape. Because, to all intents and purposes, syntax reduces to shape, and because the shape of a symbol is a potential determinant of its causal role, it is fairly easy to see how there could be environments in which the causal role of a symbol correlates with its syntax. It's easy, that is to say, to imagine symbol tokens interacting causally in virtue of their syntactic structures. The syntax of a symbol might determine the causes and effects of its tokenings in much the way that the geometry of a key determines which locks it will open. (pp. 18-19)

Fodor's second assumption is that the process of acquiring a language is a form of hypothesis testing in which the subject learns the semantic properties of its predicates. Unlike Wittgenstein and Vygotsky, who believed that meaning depends upon language, Fodor advocates the primacy of thought over communication. In Language and Thought, Fodor maintains that meaning exists prior to language in the stock of basic semantic primes that comprise Mentalese. Further, arguing on logical grounds that learning cannot increase the complexity of a system, Fodor presents the surprising claim that this innate set of essences must be richer than the concepts found in any natural language. That is, each person is born with a system of innate ideas powerful enough to generate all the meanings developed by any culture.

According to Fodor, then, the set of semantic essences from which concepts like "valley girl" and "video camera" are formed exist prior to experience. But if such atomic concepts are not learned by the individual, Fodor must explain how they are acquired by the species, presumably according to the process of evolutionary selection. It is worth pausing to consider the extent and implications of this biological nativism. For not only is Fodor claiming that this collection of primitive ideas is "richer" than those of any natural language, but also, as an innate system of thought, these inner representations must have systematic langue-like structure. Yet no evolutionary argument that could justify such claims has been offered in support of this thesis. Indeed, as Sinha (1988) argues, the modularity thesis runs counter to the claims of the evolutionary hypothesis.

> Despite, or because of, the mentalistic, rather than empiricist, orientation of the computational approach, it remains unable to account for the emergence of mind from nature, and is therefore in many respects profoundly anti-evolutionary. It should come as no surprise, then, that Chomsky, for example, repeatedly stresses the (innate) discontinuity between human mental processes and those of other species, and the biological uniqueness of manifestations of human mentality such as language.
>
> It is my argument, then, that although neo-rationalism does not explicitly disavow evolutionary theory, its deep structure provides no compelling reason for accepting it, and indeed may be read more as an argument in favour of special design. Thus, although its nativistic and maturationist biases appear at first sight to afford an easy accommodation with biology, the fact is that no mechanism is provided to account for the origins of representation in naturally evolving life. In this sense, neo-rationalism merely reflects the predominant, but implicit, biologism of contemporary psychology, rather than representing a genuine opening to psychobiological theorization. (p. 172)

Fodor and Chomsky cannot simply package the problem of mind to fit their arguments and then pass it on to biology, for psychological theories may be rejected if they make demands that cannot be satisfied by another science.

While it may seem unnatural to associate word meanings with facts about the physiological make-up of the brain, they certainly are related to the socially evolving interests that define the cultural context of life. Clearly concepts do develop historically, often, as Sampson (1981) emphasizes, in unpredictable and surprising ways. For instance, the various senses of the word "gold" from ancient times to its modern chemical characterization cannot be understood independently of the changing human interests that constitute the form of life in which it is employed. The question is whether such changes always can be generated by the finite set of innate ideas proclaimed by Fodor. That is, can concepts as diverse as "post office," "quark," and "utopia" be reduced to the same limited pool of meanings?

Fodor claims that "semantic essenceism" is the best story available, since it is the only theory that promises a scientific understanding of thought. If the mind is a physically constructed computational device, meaning must be grounded in a finite set of prime concepts. Despite Fodor's comparisons, the problem is the computer does not seem to offer a good analogy for understanding the human mind. An individual's actions cannot be interpreted solely through the lawful manipulation of brainstates, but are bound up with public rules and criteria of conduct that develop historically with the evolving concerns of a culture. That is, the intentional content of a thought cannot be captured by a finite list of semantic features. It must at least be understood in terms of its extensional reference. "Meanings," as Putnam (1975) remarked "just ain't in the head."

In his later philosophy, Wittgenstein (1955) recognizes that meaning cannot be reduced to a set of essences and introduced the concept of a language game to show how the sense of words shift, like the faces of a family, according to their application. The meaning of a word cannot be defined by reference to something outside of speech (e.g., Fodor's semantic primes), but must be understood in terms of its use within language. For Wittgenstein words are like tools. We should not ask "what defines a hammer?" but rather "how may a hammer be used?" Even a very ordinary concept like "chair" defies Fodor's attempts to provide a semantic decomposition, for considering its many forms and uses it seems unlikely that a finite set of features could capture its employment in any possible thought. Moreover, exactly how the syntactic representation of these semantic characteristics interact causally with all other mental representations remains an even bigger mystery.

Just as the history of concepts reveals how meaning depends upon public interests and concerns, so a parallel conclusion can be drawn from a study of intellectual development. Simply because an infant has the capacity to learn complex meanings does not imply that a rich stock of ideas must be present from birth. As we will see in Chapter 5, Piaget offers an alternative to this Platonic nativism by describing how--through the functional mechanisms of a general intelligence--novel meanings can be constructed in the course of experience. Indeed, against Fodor's thesis, Piaget's research, like Vygotsky's (1934/1962), clearly indicates that the intentional meaning of terms employed by children evolves during the course of intellectual development. For if in fact human beings are born with an innate language of thought, it seems highly implausible to suggest that different versions of the same concept should be formed at various stages in the process of cognitive growth.

In considering (a) the origin of the human capacity for language and (b) the relationship between individual agents and social practices, Margolis (1984) summarizes this debate. It is worth quoting him at length.

> It has proved entirely possible, as Fodor's recent popularity among those interested in psychological and linguistic studies attests, to combine the nativism of Chomsky and the extensionalism of Davidson. This is, in fact, the characteristic American direction in which biology and linguistics tend to be linked in order to provide a picture of psychology redeeming the unity of science model in what is presumed to be an up-to-date way. In effect, what Fodor recommends is that we assign a nativist supply of finitely many concepts to the genetics of the species that may be used in accord with correspondingly innate, finite rules of combination. This has the very odd result of disallowing the social learning of new concepts as well as of new ways of organizing and using concepts. It is clearly inspired by a will to resist the paradox of (1) and the introduction of a rich societal dimension (2) to human learning, human language, human conception, human cognition; it therefore serves quite neatly to clarify the point of the famous debate between Chomsky and Piaget. For Piaget, as opposed to Chomsky (and Fodor), wished to preserve richer and more powerful forms of intelligent behavior, through learning, in spite of the fact that he also impoverishes (as Vygotsky saw at an early date) the social processes by which distinctly human behavior is shaped.
>
> The upshot is that there is a contest gathering force, within the scope of psychology, regarding the social formation of distinctly human aptitudes and behavior--in that sense in which the social signifies at the very least the historical contingencies by which individual humans acquire and learn to use particular natural languages and to work within the institutionalized practices of their own societies. The analyses of these phenomena are noticeably difficult; but the principal intuition that guides inquiry regarding them, in accord with (2), is simply that languages, traditions, social practices, institutions, rules and the like are, in some sense, "possessed" by entire societies. Generally speaking, theory must avoid, here, the hopeless fiction of actual collectivities functioning as psychologically apt agents (say, in the manner of Durkheim); it must, at the same time, avoid either radically biologized accounts or accounts that treat the attributes of societies (affecting individual agency, as in speech) as analyzable in a reductive way, in terms of attributes restricted to an individualistic psychology. (p. 37)

I have argued that Fodor's attempt to establish an intentional psychology should be rejected in favor of a social conception of meaning that recognizes how ideas develop in the historical life of a culture. This dismissal of semantic essences also should be taken to undermine Chomsky's (1988a) belief that people genetically inherit a number of specific concepts (e.g., "climb"). However, since Chomsky (1980b) always has emphasized the autonomy of syntax from semantics, we must also consider the major thesis of his life's work, that the structure of language is determined by an innate computational module. According to this argument, the rules of syntax are content blind. Just as a computer can be programmed to manipulate symbols without regard to their meaning, so Chomsky thinks that the mind has an autonomous mental organ that generates well-formed sentences independently of their sense. As his most famous example, "Colorless green ideas sleep furiously," demonstrates, we are all able to construct grammatically correct sentences even when they have no meaning.

By modelling the structure of language through mathematical formulas, Chomsky believes the linguist, like Lévi-Strauss's ethnographer, can capture the mind in a new science of human nature. By maintaining that the language faculty can be investigated in exactly the same way that physicists study the natural world, Chomsky (1988b) believes he has completed the unity of the sciences program. The mind, he argues, like any other object in nature has a material structure that can be determined scientifically.

> We can, and I think should, continue to use mentalistic terminology, as I have done throughout in discussing mental representations and operations that form and modify them in mental computation. But we do not see ourselves as investigating the properties of some "second substance," something crucially distinct from body that interacts with body in some mysterious way, perhaps through divine intervention. Rather, we are studying the properties of the material world at a level of abstraction at which we believe, rightly or wrongly, that a genuine explanatory theory can be constructed, a theory that provides genuine insight into the nature of the phenomena that concern us. These phenomena, in fact, are of real intellectual interest not so much in themselves but in the avenue that they provide for us to penetrate into the deeper workings of the mind. Ultimately, we hope to assimilate this study to the mainstream of the natural sciences, much as the study of genes or of valence and the properties of the chemical elements was assimilated to more fundamental sciences. (p. 145)

Chomsky's efforts to form a science of human nature through the study of syntax continue a basic commitment to the principles of the descriptivist school, within which, in a broad sense, his work is still conducted. Two fundamental orientations bear witness to this continuity. First, Chomsky's training as a linguist stressed that the form rather than the content of language is the object of study. For the descriptivists, each term in a scientific theory had to be ostensibly or operationally definable. Although words that relate to objects could fit this criterion, concepts like "love," "hate," and "fear" escape scientific analysis. Meaning, as Bloomfield (1933) had said, was "the weak point in language study" and would remain so "until human knowledge advances far beyond its present state" (p. 140). So for 30 years after the publication of Bloomfield's Language, the study of meaning was defined outside the field of the linguist. Chomsky's modular theory of mind continues in this methodological tradition.

Second, Chomsky attempts to separate syntax and semantics by opposing the popular opinion that speech developed as an aid to communication. If, as it is often argued, those aspects of behavior that promote survival are enhanced through the process of natural selection, what better reason for the success of humanity can be found than the development of language? It thus seems natural to conclude that the structure of language should be related to its purpose.

Chomsky, however, rejects this interpretation. For him, as for Lévi-Strauss, man is a syntactic animal. Language did not originate through the desire to communicate, but was made possible by the development of new structures within the mind. Linguistic ability for Chomsky is a consequence rather than a cause of the brain's evolution. Since on this account, no interesting link can be found between the thoughts we wish to express and the rules of grammar, Chomsky ignores the social and communicative components of speech in favor of the Kantian project of inferring how the mind must be structured for language to have the syntactic rules it does.

If Chomsky's biological nativism of syntactic structures can be seen as an answer to the first of Margolis's questions--"What is the origin of the human capacity for language?"--then, along with Lévi-Strauss, he responds to the second problem by proposing that human behavior can be explained from the standpoint of methodological individualism. This can be seen most clearly when Chomsky's view of language is compared with Saussure's.

In Chapter 3 I described how Saussure divided language into two orthogonal components, langue, the network of relationship between words, and parole, which corresponds to our speech acts. Whereas the first was a study of language considered as a social fact, the second related to the individual and the psychological question of learning. This dichotomy raises two fundamental problems that Saussure's theory cannot resolve adequately. First, how is it possible to explain the development of the various, but similar, systems of langue found throughout the languages of the world? Second, Saussure's division generated the psychological problem of parole: How do individuals learn the social system of langue? I will argue that Chomsky rejects Saussure's associationist explanation and empirical learning theories in general. The individual's command of language, he argues, is of a qualitatively higher form than the sum of all previous linguistic experiences.

Chomsky's solution to both of these problems is to change the focus in linguistics from social thought to the individual idiolect. Just as Lévi-Strauss "naturalized" Durkheim, so Chomsky argues that the common laws of grammar and the spectacular feat of language acquisition can be explained when syntax is assumed to be a genotypic property of the human species. I will now consider the empirical and philosophical implications of this claim.

Grammar and Mind

In the remainder of this chapter I will present Chomsky's theory of the syntactically structured mind. I will describe the intellectual tradition within which Chomsky's work should be viewed and compare his thesis to the structuralist arguments of Lévi-Strauss and Piaget. Chomsky's "science of the mind" will be discussed along with the claim that linguistic creativity is the essential stamp of human nature. The philosophical and psychological components of this argument will be assessed, with particular attention paid to Chomsky's efforts to present his views as a modern statement of Cartesian rationalism. I will argue that such parallels are mistaken and that Chomsky's theory, like Lévi-Strauss's ethnography, should be compared to the Kantian thesis of the structured mind. Finally, I shall conclude the chapter by rejecting Chomsky's efforts to separate syntax from semantics in order to establish the existence of a biologically determined computational module within the brain. Like meaning, the form of speech depends upon the cultural and historically developing modes of life that define the purpose of human actions. Accordingly, I will conclude this chapter by arguing that language learning must be explained through the notion of a general intelligence and a socially constructive mind.

On the face of it, Chomsky's belief that a theory of grammar can provide a model of the mind may appear obvious. There is clearly a relationship between what we say and the mental structures that underlie thought. Yet this simple conclusion masks a complex set of considerations that must be unpacked if we are to understand the role that Chomsky assigns to the syntactic component in the process of language acquisition.

Chomsky's ideas developed out of criticisms he levelled against two parallel forms of analysis: descriptive linguistics and its psychological bedfellow, behaviorism. In his linguistic studies with Zellig Harris, Chomsky attempted to establish a more powerful theory of syntax that formalizes the "taxonomic" records of the descriptivist school. These theorists, Chomsky complained, concentrated on the superficial laws of surface phenomena and failed to capture the essential inner structure of language. Similarly, in his review of Skinner's (1957) Verbal Behavior, Chomsky (1959) attempted to discredit the assumption that just because behavior can be controlled through a series of reinforcement regimes in a laboratory, all human actions and abilities--including language--can be reduced to a complex of stimulus response structures. Within the context of life, with all its contingencies, language acquisition could not be explained by such a specific and superficial mechanism. In his celebrated Hixon lecture of 1948, Karl Lashley had attempted to curb the aspirations of behavioral analysis by arguing that the actions of an organism can be understood only when its internal structure is considered. This warning went unheeded, and behaviorism continued its project to explain all aspects of human learning through the generalization of observable actions. In only 10 years, this endeavor was brought down like a house of cards, as Chomsky, echoing Lashley's criticisms, presented his, at times, scathing attack on Skinner.

According to Chomsky, the most serious flaw in these twin theories is their common failure to explain the generative capacity of grammar. Whereas the descriptivists were content to record and categorize different languages, behaviorists were unable, given certain stimulus conditions, to predict a speech act on the basis of a person's language learning history. Presented with a painting, for example, I might automatically say "Turner!," but could equally well respond with "that would look nice in the living room," or "what a dreary scene!" The point is, the domains of language and human behavior contain an infinite range of possible events that cannot be predicted by the sort of surface level rules these theories propose.

As we have seen, Chomsky's solution to the problem of syntactic structure is the postulation of a generative grammar. This is also his answer to the question of language acquisition. He poses the following problem: How does a child acquire a knowledge of the same rules of language that the linguist seeks through the study of grammar? So phrased, the conclusion seems inescapable, the subject must either possess or learn an internalized set of rules that govern sentence production. Since there appears to be no way in which inner structures can be accounted for by the model of learning through reinforcement, Chomsky is able to dismiss behaviorism with the same argument that he used to dispatch the descriptivists.

For Chomsky, this generative capacity reflects the "creative" power of human nature that is witnessed in each subject's capacity to produce an infinite number of unique sentences. It should be observed, however, that by introducing this term, Chomsky (1966) is not merely identifying a technical limitation within these theories; he also is elevating his criticisms into the political sphere, implicitly rejecting the view of human nature these methodologies support.

> In its essential properties and the manner of its use, [language] provides the basic criterion for determining that another organism is a being with a human mind and the human capacity for free thought and self-expression, and with the essential human need for freedom from external constraints of repressive authority. (p. 174)

As Chomsky points out, this position had been anticipated some 350 years earlier. In the fifth part of the Discourse, Descartes distinguishes between animals--which he regards as machines--and people, not on the basis of either intellectual ability or language use, but on the capacity to put words together in a novel way. There were, Descartes believed, primates that matched the intelligence of retarded people and birds that could mimic human sounds, but only people are able to generate the range of creative sentences that allows them to participate in the linguistic community. In the following passage, Descartes (1637/1911) compares the language skills of human beings and machines that perform human tasks.

> If there were machines which had a likeness to our bodies and imitated out actions . . . we would still have . . . very certain means of recognizing that they were not, for all that, real men. . . . They could never use words or other signs, composing them as we do to declare our thoughts to others. For one can well conceive that a machine can be so made as to emit words, and even that it may emit some in relation to bodily actions which cause a change in its organs, as, for example, if one were to touch it in a particular place, it might ask what one wishes to say to it; if it is touched in another place, it may cry out that it is being hurt, and so on; but it may not arrange words in the various ways to reply to the sense of everything that is said in its presence, in the way that most intelligent of men can do. (p. 116)

Chomsky (1966) adopts this Cartesian creativity in language use as his own standard and employs it to counter the implicit behaviorist idea that "man [as] an infinitely malleable, completely plastic being . . . [is] a fit subject for the 'shaping of behavior' by the state authority, the corporate manager, the technocrat, or the central committee" (p. 184). Yet, despite the emotive power of this concept and its role in drawing attention to the limited scope of behavioral explanation, it seems out of place in Chomsky's account of language. For I shall argue, Chomsky's belief in creativity has supported a confusing affiliation with the Cartesian subject that fails to square with his empirical inquiries into the nature of mind. By exorcising this notion, the philosophically problematic question of innate ideas can be avoided and Chomsky's new rationalism can be seen more properly as a naturalistic science of the structured mind.

For Chomsky (1957), linguistic creativity is the capacity to "produce or understand an infinite number of new sentences" (p. 15). This is interpreted theoretically as the power of a generative grammar (defined in terms of the repeated application of base and transformation rule) to yield an infinite range of syntactically well-formed sentences. As Chomsky (1965) writes,

> a real understanding of how a language can (in Humboldt's words) "make infinite use of finite means" has developed only within the last thirty years, in the course of studies in the foundation of mathematics. Now that these insights are readily available it is possible to return to the problems that were raised, but not solved, in traditional linguistic theory, and to attempt an explicit formulation of the "creative" processes of language. (p. 8)

However, Chomsky's technical sense of "creativity"--defined within a mathematical model of grammar--does not apply to the innovative actions of human beings. For although it may be possible to form recursive laws that can generate the entire range of possible sentences, it does not follow that when an individual produces novel statements, he or she is acting creatively. Indeed, there seems to be very little creativity involved in this aspect of language, for it is manifestly something that everyone is able to do without any apparent effort or prior thought.

So while Chomsky claims to have adopted a Cartesian position, he appears to have missed the point of Descartes's definition of creativity as the ability to engage in an intelligent conversation. In its place, he substitutes novelty and the capacity to follow a system of rules. But as Kant (1790/1951) argues, "creativity is a talent for producing that for which no definite rule can be given" (p. 150). Indeed, it is conceivable that Chomsky's rules, along with a lexicon, could be programmed into a computer that would produce millions upon millions of new, well-formed sentences--like Descartes's automina--without a single creative thought ever being expressed. In short, if a module exists within the brain, as Chomsky claims, that is hardwired for the production of syntactically correct sentences, it is quite inappropriate to regard the application of such routines as being in any sense creative. Chomsky's terminology, while suiting his political criticisms, is out of place in a structured theory of the mind. Actions are creative by virtue of their meaning and not their form.

Chomsky and the Structuralist Movement

In Chapter 3 I presented the development of Lévi-Strauss's structuralist theory of mind against the methodological holism of Durkheim's sociology. The parallels between this naturalization of thought and Chomsky's rejection of behaviorism and descriptivism are quite striking. Indeed, even though Chomsky's ideas emerged in a different context, they are sufficiently similar to their French counterparts to be regarded as an expression of the structuralist thesis.

Some critics (Culler, 1973; Hawkes, 1977) assume that because Chomsky talks about language and uses terms such as "deep" and "structure," his theory is in the structuralist tradition. Such a conclusion does not necessarily follow. In fact, Chomsky's theory can be regarded as a reaction against structural linguistics--as practiced by the descriptivist school--and against Saussure's concept of langue. Such views of language, he argues, are taxonomic and remain married to the "myth of the museum." Rather than adopting their synchronic approach, Chomsky (1972) proposes to explain the plethora of different languages and the psychological problem of parole, through the idea of a universal grammar. In place of a socially evolved corpus of rules, Chomsky makes the individual idiolect the seat of language and searches for innate psychological structures that can produce syntactically correct sentences. These twin features of Chomsky's theory should be compared to the ideas of Lévi-Strauss and Piaget. All three seek rule-governed systems of transformation, Lévi-Strauss's examination of myths, Piaget's analysis of intellectual stages, and Chomsky's laws of grammar all employ abstract mathematical models to capture the underlying structures that support the mental operations found in these areas.

The most obvious structuralist theme in Chomsky's work is thus the reduction of surface phenomena to sets of inner logical rules. In this respect, Chomsky's rejection of behaviorism and descriptivism parallels Lévi-Strauss's criticisms of traditional anthropologists--like Frazer and Radcliffe-Brown--and their attempt to study culture through direct reports of native life. Further, both Lévi-Strauss and Chomsky reject the social basis of thought and the historical development of reason in favor of a methodological individualism that explains the human mind through the biologically determined structures of the brain, a claim that Chomsky (1967) supports by demonstrating the existence of cognitive universals.

> Deep structures seem to be very similar from language to language, and the rules that manipulate and interpret them also seem to be drawn from a very narrow class of conceivable formal operations. . . . Furthermore, the underlying abstract structures and the rules that apply to them have highly restricted properties that seem to be uniform over languages and over different individuals speaking the same language, and that seems to be largely invariant with respect to intelligence and specific experience. (p. 7)

Structuralism is associated by many with Foucault's (1966) description of the "death of man" in the social sciences. This "rallying cry" seems to counter Chomsky's "individualism" and his rejection of impersonal forms of analysis. But Lévi-Strauss, who also rejects the subject, has campaigned for the rights of individuals and the autonomy of native societies. The point is to separate the psychological self (individual personalities) from the epistemic subject (the set of intellectual structures that underlie thought). Lévi-Strauss and Chomsky share the conviction that knowledge of the human mind cannot be acquired through introspection. Consciousness, as Lévi-Strauss observes, is just a private empirical field of thoughts ruled by the same laws of structure that are observed in the organization of social phenomena. Further, both Lévi-Strauss and Chomsky claim that subjects tacitly or unconsciously "know" the rules of thought (e.g., in kinship regimes or grammar), even though they are not aware of the structures that "cause" them.

Chomsky's reliance on the linguistic intuitions expressed by native speakers is simply a means to determine the accuracy of his grammatical rules and should therefore be compared with Lévi-Strauss's concept of a semantic field. This emphasis on the external manifestations of a common, innate, biological endowment, rather than a concern for the experiences of particular individuals, makes Chomsky's search for mind a competence model of an ideal or universal speaker. Both generative grammar and ethnography are attempts to evaluate logical models empirically by testing their capacity to duplicate the psychological structures of thought. Indeed, far from reducing the subject to a set of structures, each author, following Rousseau, believes that it is the richness of our shared biological nature that establishes the freedom and dignity of men and women in all societies.

In sum, although Chomsky worked outside the French structuralist movement, he established a new form of psychology that, like Lévi-Strauss's anthropology, aims to model the mind with an algebraic description of deep mental transformations. Such mechanisms, which are inferred from various external manifestations of human thought, are seen as a product of the material structure of each subject's brain. Chomsky's theory is thus a naturalistic study of the structured mind, which, as I will now discuss, also proports to be a science of human nature.

Chomsky and the Unity of the Sciences

To determine the nature of inner psychological structures, Chomsky (1965) initially proposed to model the linguistic abilities of the speaker with his formal theory of grammar. By developing grammatical rules and structures that progressively approach our intuitions of syntactic relationships, psychological laws of thought can be represented in mathematical terms.

> Using the term grammar with a systematic ambiguity (to refer, first, to the native speaker's internally represented "theory of his language" and, second, to the linguist's account of this), we can say that the child has developed and internally represented a generative grammar. (p. 25)

For Chomsky, therefore, a formalization of linguistic rules at the same time yields a logical model of the psychological mechanisms that generate the syntactic laws of speech. Moreover, he also maintains that the most parsimonious explanation of the public structures of language corresponds to the best scientific theory of the subject's mental representations. It must be remarked that this conflation of linguistics and psychology is viewed as highly controversial by many professionals within each discipline (Moore, 1983; Sampson, 1981). Why should the most economical linguistic rules be associated with a superior theory of the brain's structure when there seems to be no logical or biological necessity for the human mind to evolve toward simplicity? Indeed, if Gould (1977) is correct, under evolutionary selection the developmental history of an organism should lead to complex rather than an efficient configuration. In short, Chomsky's claim that the best theory of language is also the best theory of the brain remains unsupported.

Why should a theory of language be a theory of the brain at all? It is quite possible to write "grammars" for all sorts of human activities, from playing chess to recognizing facial expressions. Yet this does not imply that such rule governed systems must therefore be psychologically real. The fact that I can generate an infinite number of chess moves does not mean that my brain is hardwired with a specific module for that game. As Putnam (1980) argues in response to Chomsky's comments at the Abbaye de Royaumont,

> much of Chomsky's reply to me rests on the mistaken assumption that anyone who denies that grammars describe properties of the brain is committed to denying that they are represented in the brain. This is a non sequitur. I deny that the grammar of propositional calculus is a description of properties of my brain; but I do not deny that, if I learn propositional calculus, some representation of that grammar (probably not the one I should use in writing a logic book) will be formed by my brain. The geography of the White Mountains is represented in my brain; but the geography of the White Mountains is not a description of my brain.
> (pp. 335-336)

Chomsky, of course, should not be read as implying that particular features of all natural languages must be biologically encoded in the brain. Rather, he claims the existence of more general mechanisms from which such rules can be derived in the course of experience. In his most recent statement of this position, Chomsky (1988b) likens language learning to the task of setting a system of mental switches. When appropriately aligned, such parameters will define mental circuits that generate the syntactical rules of any natural language. In this view, the development of a language should be compared to the "growth" of bodily organs whose structural maturation is "triggered" by the environment. If this is the case, Chomsky (1980a) suggests, then the same method of analysis used by natural scientists in the study of other human capacities (like sight, hearing, smell, and so on) can be applied to the investigation of mind.

> It is a curiosity of our intellectual history that cognitive structures developed by the mind are generally regarded and studied very differently from physical structures developed by the body. There is no reason why a neutral scientist, unencumbered by traditional doctrine, should adopt this view. Rather, he would, or should approach cognitive structures such as human language more or less as he would investigate an organ such as the eye or heart. (p. 37)

Chomsky's ambition is thus to complete the unity of the sciences program by demonstrating that the mind can be studied by linguists with the same methods of theory construction that are employed in the natural sciences. This is an enterprise which, as Sinclair (1987) explains, is fully endorsed by Piagetians:

> We try to reach the competence of the child through many "peripheral" approaches (experimental, often contrived, situations where either the child's comprehension of certain sentences is investigated or his production is elicited, studies of the way he judges certain sentences and other meta-linguistic studies, comparative studies in different languages, etc.) since there is no direct way of studying this competence. Exactly like Chomsky, when challenged we can do no more than "repeat the evidence and the proposed explanations." Also like Chomsky, we explain that we try to devise a theory in regard to what we have observed and to test this theory by its success in providing explanations. In other words, both Chomsky and the Genevan psycholinguists defend their approaches to the problem of language competence as scientific, and as the only possible ones (in our own views) given the nature of the object of our enquiries. (pp. 173-174)

For Chomsky, like Piaget and Lévi-Strauss, science is the structuralist enterprise of building mathematical models--through the process of inference--that will represent observable phenomena. Further, again like Piaget and Lévi-Strauss, Chomsky also advocates a realist philosophy of science.

As the degree of confirmation for a theory increases, so he believes, the scientist is warranted in assuming the physical reality of a postulated model. As Chomsky (1975) explains, the linguist's strategy

> is precisely the approach that would be taken by a scientist or engineer who is presented with a black box that behaves in a certain fashion, that evidences a certain input-output relation, let us say. The scientist will try to construct a theory of the internal structure of this device, using what observations he can as evidence to confirm his theory. If he is unable to investigate the physical structure of the device, he will not hesitate to ascribe to the device a certain abstract structure, pehpas a certain system of rules and principles, if this turns out to be the most successful theoretical approach. There is no reason to adopt some different standpoint when the object under investigation is the human being. (p. 43)

For Chomsky, knowledge is a state of the brain, so the mental representations that underlie language can be reduced to biological structures with a material existence. Linguistics for Chomsky is therefore a naturalized science of physically real mechanisms.

Where critics like Sampson (1981) and Moore (1983) part company with this argument is at Chomsky's union of linguistics with biology. For, Chomskyans aside, most linguists do not believe that in describing the public structures of a natural language they are also investigating the psychological mechanism of the mind. As McNeill (1979) argues,

> grammars . . . refer to real structures, though not to psychologically real structures in the processing sense . . . a grammar is a description of our knowledge of a social institution--the language--and because of this basis in social or institutional reality, rather than in cognitive functioning, grammars and psychological processes have no more than the loose relationships they appear, in fact, to have. The role of grammar during speech programming is analogous to the role of other social institutions during individual behaviour. This role is to define and evaluate the behaviour of individuals. It is not to cause the behaviour. (p. 293)

Language, Sampson (1981) argues, exists independently of the individual's idiolect in Popper's (1979) world 3, defined by the public concepts and traditions of cultural life. It is not denied that Chomsky's analysis of grammar describes the structure of language, or that subjects will come to follow such rules, but rather that the laws of language can be reduced to facts about the physical make-up of the brain. Like Margolis (1984), Sampson believes that language is constructed in the socio-historical flux of life, a context from which even its syntactic structure cannot be factored out.

I will return to this issue in considering Chomsky's arguments for the autonomy of syntax from semantics. The important point to recognize at this stage is that the conflation of linguistics with psychology is both questionable and controversial. Chomsky has not provided arguments that are any more convincing than Lévi-Strauss's for the biological basis of mind and certainly has not won the case for a scientific inquiry of human nature on the strength of his belief that linguists employ the same method of analysis as scientists. Mathematical models of language do not have to be psychological models of mind.

Plato's Problem

Chomsky (1988a) names the question of how the mind acquires a knowledge of language "Plato's problem," and like Plato proposes that nativism is the only theory that can provide an acceptable answer. (Chomsky (1988a) also presents a parallel question, "Orwell's problem," in the area of political understanding: "How is it that people can know so little given so much information?") To substantiate this claim and explain how individuals develop the generative capacity evidenced in the everyday use of language, Chomsky applies his theory to the facts of linguistic growth in childhood. In essence, Chomsky argues that empiricist theories of learning cannot--in principle--account for the subject's development of the grammatical rules suggested by his formal studies. The facts of language acquisition, he suggests, can only be explained through the presence of an innate language module within each infant's brain. I shall discuss these psychological claims, which, I will argue, are not as convincing as Chomsky maintains.

The discussion of Plato's problem also provides Chomsky with the opportunity to explore some of the philosophical implications of the nativist thesis. Over the years Chomsky has advanced two important claims: first, that all subjects are born with an innate knowledge of language, and, second, that his linguistic arguments support Descartes's rationalist epistemology. In the sections that follow I will reject both positions. I shall argue that individuals do not know language in the sense that Chomsky maintains and that his desire to align his ideas with those of Descartes is based upon a dubious reading of the Cartesian theory of knowledge. I will then conclude by demonstrating that Chomsky's arguments can be more profitably interpreted as a version of Kant's thesis of the structured mind.

Chomsky's Psychological Theory

Chomsky prefaces his psychological arguments by asking how human beings acquire the generative rule system that his linguistic studies demonstrate is necessary for the production of syntactically well-formed sentences. That is, how do men and women learn to talk the way grammar "talks?" As we have seen, Chomsky's answer is to postulate a structured mind that is innately programmed to interpret the rules of particular languages. Were neurophysiology sufficiently advanced, a "bottom up" study of the brain could be undertaken to correlate such mental structures with grammatical rules. However, since this sort of inquiry is beyond our present means, Chomsky, like Lévi-Strauss, conducts a preparatory study of the mind by constructing models that match its capacities. This task, he claims, is similar to that undertaken by 17th century philosophers in their attempts to discover the nature of vision. Unable to conduct precise anatomical investigations of the eye, they formed hypotheses on the mechanics of sight from their knowledge of other optical devices and from the phenomenological experience of vision. In a similar fashion Chomsky's inquiry might thus be summed up as a Kantian quest to discover the properties of mind that human beings must possess in order that they can speak the way they do.

To decide between rival theories, Chomsky employs the same criteria he adopted in his linguistic studies. First, if two models appear to share the same explanatory power, the mathematically simpler one should be selected. Second, the acid test for any hypothesized psychological structure is the degree to which it matches a speaker's intuitions. Chomsky (1987) then sets up his "black box" investigation of the language acquisition device (LAD) with the following model.

INPUT ----> LAD ----> STRUCTURED OUTPUT

Clearly the LAD must have some properties; at the very least it should explain how the mind can learn from experience for as Hume recognized in basing the idea of causality on the habit of association, the ability to make inferences must come from the "original hand of nature." This theory of minimal inheritance, which Chomsky identifies with empiricism, does not credit the innate component with any specific faculty for acquiring language, but attempts to explain all learning on the basis of a general set of intellectual capacities.

> The empiricist hypothesis claims that the language acquisition device operates essentially by principles of inductive generalization which associates observable features of utterances with one another and with other relevant sensory information to obtain an internalization of the rules of a linguistic description. (Katz, 1966, p. 247)

Conversely, the acquisition device cannot be so detailed as to contain the complete grammatical structure of all languages. Within these limits, Chomsky aims to hypothesize the LAD capable of both generating the grammars of all human languages and explaining how children are able to acquire linguistic skills in the observed limits of time and accessibility to information. Since the model to be accepted is the one that most successfully explains the phenomena of language (according to the criteria stated), Chomsky's empirical arguments often degenerate into a form of "theory bashing." Typically, he attempts to discredit rival explanations by demonstrating their inability to account for the details of language acquisition. The principal theory that Chomsky wishes to tar with this contextual brush is, of course, behaviorism. However, it often seems that Chomsky erects a theoretical Aunt Sally (straw man) which, when knocked down, will serve to showcase his own arguments as the only plausible explanation of language development. It should be remembered therefore that behaviorism is not the only theory of learning, and Chomsky cannot win this argument by default.

To undermine the behaviorist account, Chomsky focuses the reader's attention on the LAD and asks us to consider the effort that would be required for a person to learn this mechanism from experience. As he observes, an appropriate psychological theory must explain more than just a speaker's actual utterances, since these offer only a limited and degenerate representation of their real abilities. The LAD is thus a model of linguistic competence. This is an important point, for Chomsky wants to demonstrate that the rule governed character of language--which determines what a speaker can say--goes beyond associationist explanations that limit the subject to habitual responses learned from past experiences. In brief, he claims that the input and the output of this model are of a different order and presents two classes of arguments to support his conviction that this disparity entails an innate capacity for language. One is empirical, the other conceptual. I will examine each of them.

Chomsky's empirical considerations raise four main issues. First, he argues that the input data is both degenerate and fragmentary. The sounds that a child hears and--according to the behaviorists--combines into a knowledge of syntax, are so riddled with slips of the tongue, colloquialisms, and grammatical errors that they bear little or no resemblance to the subject's eventual linguistic command. This claim, it should be noted, is not supported by all psychologists. As Labov (1970) argues,

> the ungrammaticality of every-day speech appears to be a myth with no basis in actual fact. In the various empirical studies which we have conducted . . . the proportion of truly ungrammatical and ill-formed sentences falls to less than two percent. (p. 42)

Chomsky responds that even with a two percent error the input data still provide too problematic a basis for the construction of scientific theories. But unlike the researcher, the child is not a scientist and does not make conscious decisions about what to count or disregard within experience. So despite the inevitable degeneracy of the input information, it is not so obvious that grammatical rules cannot be learned from experience.

Chomsky (1968) names his second empirical point the "poverty of the stimulus" argument. Again he believes that empiricist accounts of learning cannot explain the linguistic competence of a speaker to construct and understand an infinite range of sentences on the basis of the child's relatively short exposure to language.

> Compared with the number of sentences that a child can produce or interpret with ease, the number of seconds in a lifetime is ridiculously small. Hence the data available as input is only a minute sample of the linguistic material that has been thoroughly mastered as indicated by linguistic performance. (p. 3)

Against this, Putnam (1968) argues that compared with the average time it takes university students to learn another language, children have an immense learning period of time at their disposal. For Putnam, then, the "phenomenal" task of acquiring a language does not appear as miraculous a feat as it does to Chomsky. But, Chomsky counters, learning a second language is quite a different process from the acquisition of a native tongue. This is Chomsky's third point. When children learn to speak, they are not normally presented with the structural features of languages--the set of "substantive universals" such as noun, verb, and so on; indeed, adults typically do not make any conscious effort to teach grammar to the young. Moreover, advances in linguistic competence occur at a time when the child's other intellectual skills are still developing. Further, as studies of feral children suggest, the ability to learn a first language is lost around the onset of puberty. These facts, Chomsky claims, do not sit well with the notion of the generalized learning ability demanded by the empiricist account.

Chomsky continues his attack on empiricism by noting that vast differences in motivation and intelligence seem to have little bearing on the process of language acquisition. Even children with severe learning difficulties appear to develop linguistic skills without any apparent effort. Such considerations lead Chomsky (1988b) to reject the common-sense belief that languages are in any sense learned, in favor of a growth analogy of development. According to his current view, experience merely triggers maturation of an innate modular mechanism.

> Language seems to me to grow in the mind, rather in the way familiar physical systems of the body grow. It's not inappropriate to regard the mind as a system of mental organs--the language faculty being one--each of which has a structure determined by our biological endowment. (pp. 205-206)

Fourth, Chomsky has shown that while languages may vary in terms of their substantive universals, each nonetheless can be characterized by a common set of transformation rules. These are the "formal" universals that Chomsky--like Lévi-Strauss--identifies with the psychological structures of the mind. Traditionally it was thought that the variety of human languages spoke against the existence of an innate mechanism, since each language exhibited a unique attempt to fit a socio-cultural and environmental niche. Chomsky has turned this argument on its head. Since there is no a priori reason why human beings should employ complex deep structures rather than simple grammars, he takes the presence of formal universals in all languages as a vindication of his thesis. "The only thing . . . that can provide the invariant condition that we want to correlate with the universal features of language as the causal antecedent is the common innate endowment of human language learners." (Katz, 1968, p. 30)

Chomsky's conceptual argument turns on the logical impossibility of deriving formal universals from the substantive features of a grammar. The surface structure of language is separate from the set of transformation rules required for lingusitic competence, yet on the empiricist account the words and sentences heard by a child provide the only information upon which to formulate such abstract rules. Chomsky thus argues that the behaviorist model of learning cannot, in principle, explain how inner rules are acquired from surface information.

But as Russell (1987) and Sampson (1981) argue, exactly the same hierarchical structures are predicted by the laws of systems theory when language is considered as a social construct. Words and meanings can be held together only through an underlying system of rules and conventions, and it is this inner order that supports the continuity of language as it evolves historically. Furthermore, they argue, when children acquire speech, they do not learn to associate words and meanings, but to construct the internal framework that holds language together. Like Putnam (1980), these authors also reject Chomsky's characterization of learning as being limited to the acquisition of content. In contrast they propose a Popperian view of the gradual development of structure through the process of hypothesis confirmation. In Chapter 5 we will see that this evolutionary epistemology has some similarities to Piaget's view of learning and suggests that the child's developing system of concepts parallels the social construction of thought. As Sampson (1980b) summarizes his argument,

> H.A. Simon (1962) has argued that, for reasons having to do with the mathematics of probability, any complex product that has emerged from a process formally akin to that of Darwinian evolution will be expected to manifest certain fairly general structural properties, having to do with the notion of "hierarchy." . . . I have argued that, on the Popperian . . . the acquisition of syntax would be an evolutionary process in the sense required for Simon's argument to be applicable . . . (Furthermore, on this view, the individual's acquisition of language would in its general outline recapitulate the process by which languages emerged within originally languageless communities.) If the Popperian, non-nativist view is correct, then we would expect the languages that have developed in each human community, and likewise the individual mental representations of their mother-tongue that are attained by each member of a speech-community, all to share certain abstract grammatical properties (while differing in detail); they should all be based on hierarchical structure, and the syntactic operations found in them should always be "structure-dependent" ones. (p. 35)

The followers of Popper (e.g., Shina, 1988), like the researchers in the Piagetian tradition (e.g., Sinclair, 1987), agree with Chomsky that language acquisition depends upon a rich biological endowment, but they reject the modularity argument in favor of general purpose cognitive abilities. From the perspective of evolutionary theory, the case for such overall skills is more plausible than the advocacy of domain specific capacities and accords with the common sense belief that language is a tool for communication. Sinclair (1987) thus speaks for both schools when she argues,

> I see language as a tool constructed by the human mind (on the basis of its innate capacities) in the service of representation and communication, when humans became capable of and felt the need for the construction of such a tool. Therefore, even in a modular conception of human cognition, I cannot see universal grammar as a primary, independent unit, but believe basic language competence to be constructed by the child subsequent to and on the model of the child's fundamental achievements during the pre-verbal practical intelligence period--achievements that bear on his knowledge of the physical as much as of the social world he lives in. (p. 176)

By considering the progressive grammatical competency of children, Sinclair (1987) supports her thesis by demonstrating, in the face of Chomsky's (1980a) arguments, that language skills are in fact learned in the course of experience. While such studies are a long way from explaining the processes by which subjects acquire the hierarchical rules of language, they do lend credence to Piaget's constructivist theory of development. For however unsatisfactory Piaget's arguments seem, they do provide a useful first approximation to the question of how children develop structure-dependent conceptual schemes. Indeed, Piaget anticipates Chomsky's criticism of the empiricist view of learning--as being incapable of explaining the structure of thought--and purposefully attempts to show how such "grammars" are developed in the course of experience. For Piaget, as we will see in Chapter 5, all learning from basic physical schemes to the level of abstract thought depends upon the construction of hierarchical systems of rule-governed actions. So while Chomsky's criticisms of the behaviorist position are difficult to resist, his arguments do not win the case for the rationalist hypothesis.

As Putnam (1968) observes, Chomsky's method typically involves presenting a series of "what else" arguments. What else could possibly account for the facts of language acquisition than an innate knowledge of grammar? Yet the fact that Chomsky does not entertain other theories does not mean that alternative explanations cannot be formed. According to Putnam (1968), Chomsky simply has set behaviorism up as a straw man. Putnam argues that the criticisms levelled by Chomsky do not preclude the construction of hybrid empiricist theories that can meet all the conditions of the LAD model. There are more than two psychological theories in the field, and Chomsky cannot crown his explanation just because one of his opponents has been discredited.

Having dismissed empiricism as a tenable explanation of language acquisition, Chomsky pursues his own thesis by specifying the features that a language module must possess to account for the facts of development. His early arguments betray much of his uncomfortable liaison with classical rationalism, for he initially believed that children develop a particular grammar in the same way that a Cartesian scientist approaches an empirical problem.

Chomsky originally proposed the following psychological mechanisms. The innate component has a built-in "weighing" function that assigns a priority to a class of possible grammars, g1, g2, g3, . . . , that the subject may compose from the set of transformational rules with which the mind is biologically programmed. When a child is exposed to language, many of these sequentially hypothesized grammars will be tested--unconsciously--and found to be inconsistent with experience. Eventually, however, as the child progresses through the set, the highest valued system compatible with the rules of the native language will be selected. As with Descartes's scientific method, Chomsky (1968) believes that "experience does not serve to provide the things to be copied by the mind, as in the empiricist account, but to help eliminate false hypotheses about the rules of language" (p. 278). In Chomsky's (1975) early model, the child is thus seen as a Cartesian scientist engaged in the activity of cracking the inner code of language.

> The construction of a grammar of a language by a linguist is in some respects analogous to the acquisition of language by the child. The linguist has a corpus of data; the child is presented with unanalyzed data of language use. The linguist tries to formulate the rules of the language; the child constructs a mental representation of the language. The linguist applies certain principles and assumptions to select grammar among the many possible candidates compatible with his data; the child must also select among the grammars compatible with the data. (p. 11)

Although there are some interesting similarities between these respective tasks, there remains at least one important difference. We may talk about a linguist's knowledge of language, but it does not follow that the same understanding should be attributed to children simply because they are able to follow grammatical rules. This confused union of psychological mechanisms and linguistic theories--of the child and the grammarian--ultimately proved the untenability of Chomsky's account. Like the behaviorist theory he attacked, Chomsky's (1972) model could not overcome his own "poverty of the stimulus" argument, for the unconscious selection of a grammar was to be achieved by all human beings, despite their differences, on the basis of the same degenerate information with which the empiricist model must work. "Formally speaking, the learner must select a hypothesis regarding the language to which he is exposed that rejects a good part of the data on which this hypothesis must rest." (p. 77)

The impossible problem that Chomsky faced was to write an algorithm for this unconscious procedure that could determine a particular grammar from the paucity of information available. His efforts led him to the construction of an extremely complex set of selection rules that seemed to defeat his own observations on the speed and simplicity of language acquisition. He thus faced a parallel problem to his behaviorist opponent: How can children make such involved judgments on the basis of their limited experiences?

As I have described, Chomsky (1988b) recently has rejected all efforts to explain language acquisition as a form of learning, including his own early Cartesian hypothesis, in favor of viewing the language faculty as an organ that grows within the mind. According to his new account, language grows in the brain in the same way that arms and legs grow with the body.

> The conception that I would now want to propose of what's called Universal Grammar, the theory of the initial state, the genetically determined system, would not be a format for rule systems with a method of hypothesis testing to choose among them, but rather something quite different. To select a different metaphor, it would be something like a system which has an intricate and complex wiring but with some of the connections not established and with, say, a box of switches that can be in one of several (pehaps just two) positions, thus putting the system in full working order. Now, the switches are what are called "parameters." They have to be set by experience--experience has to tell you how to set each of these switches. Once you set them in one of the permissible ways, you have acquired a particular language. If the system has a sufficient internal complexity, changing the setting of one switch may have quite wild effects on the outcome, unpredictable and complex effects. You also may find that languages that separated relatively recently--say French versus the other Romance languages--will differ in clusters of properties, maybe only because one switch was flipped somewhere along the line and that had a whole complex range of consequences. (pp. 453-454)

To combat the poverty of the stimulus argument, Chomsky maintains that parameters must be set by very clear and simple linguistic clues. For example, it is possible to distinguish a number of grammars on the basis of only a few verbal statements by recognizing whether a language is "head first" like English, where verbs preceed objects, or "head last" where verbs follow objects, as they do in Japanese.

It will be observed that the initial wiring of the brain's language module is more constrained and complex than it was under Chomsky's original formulation. Like Fodor, Chomsky's arguments have approached a more radical nativism, shifting everything that cannot be explained by his earlier Cartesian hypothesis into the innate structures of the mind. By further abstracting the nature and origin of language from the socio-historic context of life, Chomsky has continued his efforts to pass Plato's problem over to the natural sciences. But this "biologism," far from furthering the unity of the sciences program, actually reduces Chomsky's project to a form of metaphysics. As Dennett (1980) explains,

> Chomsky's arguments, from the poverty of the stimulus and the speed of language acquisition, . . . purport to show that there must be large gifts of design in the infant if we are to explain the speedy development of the mature competence. And while we can take solace in the supposition that we may someday be able to confirm the presence of these innate structures by direct examination of the nervous system . . . we will have to accept the disheartening conclusion that a larger portion than we had hoped of learning theory, considered in its most general form as the attempt to explain the transition from utter ignorance to knowledge, is not the province of psychology at all, but rather of evolutionary biology at its most speculative. The more the infant brain can be viewed as a tabula rasa, the more accessible to experimental research the ultimate mysteries of learning will be; if the facts constrain psychologists to pass the buck to the evolutionary biologists, we will have to settle for more abstract and speculative answers to the ultimate questions. (p. 19)

This difficulty surfaces in two limitations that face Chomsky's scientific project. First, although Chomsky has described the logical structure of the language acquisition model, he has yet to flesh out this explanation with a complete list of all the parameters necessary to define any natural language. The identification of this system of switches is obviously not a simple matter, but it is not clear that Chomsky's method of mathematical modelling can achieve his end even in principle. For like Lévi-Strauss's binary analysis, the logical structures Chomsky postulates might turn out to be just one in a number of equally consistent descriptions of linguistic phenomena, models that cannot be selected according to considerations such as mathematical simplicity. As I have argued already, logical concerns do not necessarily pertain to the question of psychological reality. Moreover, and this is my second point, since these abstract models tend to encompass the entire range of linguistic phenomena, hypotheses often appear to be beyond empirical falsification, thus raising the Popperian criticism that the structuralist study of mind proposed by Chomsky is as unscientific as that developed by Lévi-Strauss.

Knowledge and Language

Chomsky's criticism of the behaviorist account of language forms the cutting edge of his more general attack on empiricism as a coherent epistemological position. Empiricism, he believes, has become so deep-seated in the western mind that it has taken on the character of a superstition. However, since Chomsky believes he has demonstrated the existence of an innate knowledge of language, he attempts to undermine this attitude by advocating a new form of rationalism. In fact, Chomsky's aspirations are even grander, for in demonstrating the inability of empiricism to account for the facts of language acqusition he re-opens the age-old debate between these epistemologies in order to settle an old philosophical score on behalf of the rationalist movement. His premise is that human beings have a knowledge of language that cannot be explained through experience. For example, Chomsky claims that all English speakers know that "George loves Barbara" is a well-formed sentence, whereas "loves Barbara George" is not. Yet, he recognizes that such "knowledge" is not normally part of the subject's conscious understanding. Chomsky thus arrives at the apparently contradictory conclusion that we have an unconscious knowledge of language.

Chomsky supports his arguments for an innate knowledge of language through his reading of Descartes. Yet it is not clear that Descartes would wish to ally his ideas with Chomsky's theory. For while he accepted that experience "triggers" thought, his dualist metaphysics casts the mind in a very different role to Chomsky's naturalism. As I described in Chapter 2, Descartes believed that knowledge comes through the presentation of clear and distinct ideas before an attentive mind. The notion of unconscious knowledge would, in all probability, have been an anathema to him.

The chief problem with Chomsky's argument is that he fails to specify exactly what kind of knowledge he thinks our knowledge of language is. Indeed, many of Chomsky's critics spend a good deal of time trying to sort out the different senses of knowledge in order to clarify what could be meant by such a claim (Cooper, 1975, Harmon, 1968). The following three hypotheses about the human mind will serve to orient this debate:

A. Human beings are innately disposed to learn languages--among other things--although they are not born with a knowledge of its rules. This sense of a weak genetic inheritance incorporates a conception of general intellectual capacities.

B. Hypothesis A can be enriched by claiming a specific capacity for language-learning, which, however, does not lead to a propositional knowledge of grammatical rules. On this account the subject is "hard-wired" to follow the laws of syntax.

C. Every child has an innate knowledge of linguistic rules that, like software information, are "read off" and used to direct behavior.

Each of these hypotheses can be linked with a particular kind of knowing. The first, which models language acquisition on procedural rules, is associated with "knowing how." Hypothesis C can be regarded as an example of "knowing that" while B, which as I read it is Chomsky's (1980a) choice, has been labelled somewhat ambiguously as "knowing of" or "cognizing."

"Knowing how" is the most appropriate category for empiricists to employ because it does not imply the existence of any innate mental representations. Language acquisition is explained through the same set of mechanisms and capacities that underlie all other forms of learning. Of course, as I have argued, the empiricist admits that we cannot acquire knowledge without certain dispositions--even Locke recognized this in his criticism of innate ideas--and readily accepts a certain level of genetic inheritance. As Quine (1968) says, "The behaviorist is knowingly and cheerfully up to his neck in the mechanisms of learning readiness. . . . Innate bases and dispositions are the cornerstone of behaviorism" (p. 200).

Pursuing this line, critics like Quine (1968) and Harmon (1968) have compared the capacity to form grammatical sentences with the ability to ride a bicycle. Such skills, they argue, make no reference to mental states and consequently do not invoke any knowledge of the rules that control our behavior. They simply affirm that we are able to perform certain acts. So, while a cyclist may follow a number of laws when riding (e.g. differential equations relating forces and velocities) this does not imply that he or she has any knowledge of them. The point is, if our use of syntax is like our ability to ride a bicycle, there is no reason to attribute to the speaker any knowledge, conscious or otherwise, of grammar. Subjects merely act in accord with the formulae derived by linguists. To ascribe to them an innate knowledge of these rules, it has been said, is like assuming that projectiles know the laws of physics.

Chomsky (1968) rejects the "knowing how" hypothesis and resists all attempts to describe linguistic abilities as the acquisition of skills. The capacity for speech, he argues, unlike physical skills, cannot be explained through such "superficial" descriptions of a person's behavior.

> We do not attribute knowledge of mechanics to a bicycle rider if in fact this assumption does not help explain his ability to ride a bicycle: we attribute knowledge of the rules of grammar to the speaker-hearer if this assumption does contribute to an explanation of his ability to use language. (pp. 154-155)

According to Fodor (1983), Chomsky's explanation of linguistic abilities is a clear case of hypothesis C.

> Innate structure isn't innate mechanism in Chomsky, it's something like innate information. So if you look at what Chomsky actually gives arguments for, it's something like the Cartesian idea that what's innate is a body of representations (or rules or something), perhaps a specification of all possible human grammars. What's innate, you might say, is text; and it's a little hard to see what, on that view, Chomsky's repeated analogies to innate organs (limbs and things like that) are supposed to come to. (p. 5)

On Fodor's interpretation, the subject is supposed to "read off" a set of rules and apply them in the construction of sentences. Yet Chomsky explicitly denies that we are born with a propositional knowledge of language. In his debate with Harmon (1968), for example, he asserts that our knowledge of language "obviously" cannot be of the "knowing that" kind, since only linguists are aware of such mathematical rules.

As Chomsky recognizes, propositional knowledge is usually defined in terms of three components: truth belief, and justification. While speakers clearly can claim the first two conditions, normal subjects are quite unable to offer reasons for their use of syntax. Such laws exist beyond conscious introspection. The "knowledge of language" that Chomsky wishes to establish thus shares the characteristics of the "knowing-that" category without having to be grounded. Since every English speaker can recognize that "George loves Barbara" is a well-formed sentence, Chomsky believes that it makes little sense to demand that such "knowledge" must be justified. He therefore proposes a new category, which he terms "cognizing," and offers it as an alternative to the knowing-how, knowing-that dichotomy.

Cooper (1975) sheds light on the inappropriateness of these traditional forms of knowledge for the description of linguistic competence. Each category is useful in describing only what has been learned through experience. That is, in saying I know how to ride a bicycle, speak French as a second language, or play the piano, I can point to a set of activities through which these skills are developed. The same can be said of my knowledge that Paris is the capital of France or that Chomsky's first name is not Noam, but Avram. The problem comes when we try to use these categories to explain what has not been learned. For example, we do not normally say that the heart "knows how" to pump blood around the body or that a baby "knows that" it should cry at birth.

Chomsky (1988b) wants to find a middle way between these two categories of knowing that does not commit the speaker to a conscious knowledge of rules nor reduce linguistic competence to a set of habits. He therefore suggests that the speaker has a "knowledge of" or "cognizance of" language that is caused by the structure of our mental organs.

> Knowledge of language is basically a computational system, that is, a system of principles of one sort or another that determine a set of mental representations, principles which determine it in a very precise and explicit and highly articulated fashion and ultimately correlate them with representations of sound and with other conceptual systems that allow them to be part of their interaction with one another and human intercourse. That's what knowledge of language is. It is a kind of computational system.
>
> The knowledge that is acquired includes, in fact entails, a paradigm example of knowing that so-and-so. People know that this sentence means such-and-such and they know that this word is pronounced in such-and-such a way and so on and so forth. Here is, in fact, an unbounded range of essentially paradigm cases of fact that we have knowledge of. And it appears overwhelmingly likely, I think the evidence is extremely strong, that this knowledge is not acquired by any reliable procedures, is not justified in any general terms, and is not grounded in any useful general sense of the term "grounded," in fact, violates virtually every condition that has been proposed as a necessary condition for existence or attainment of knowledge. Rather the knowledge grows, because we are so constituted that under the rather limited and defective experience a certain system takes shape in the mind, and that system is a system of knowledge. (pp. 586-587)

If indeed language is caused by an innate computational system, it nonetheless seems inappropriate to equate such brain states with knowledge. Surely as Cooper suggests, whatever knowledge we may have of human linguistic abilities is built up through experience. A person may know that a word is used incorrectly or know how to construct a well-formed sentence, but such knowledge is only acquired by observing our own actions and the behavior of others. After all, while Chomsky may claim that babies inherit an innate language faculty, he could hardly maintain they are also born with a knowledge of its application. Chomsky finds himself in the impossible predicament of explaining how we can have unconscious knowledge of what cannot be known in conscious thought because he has been lured into the empiricist-rationalist debate. These epistemologies have generated a specific perspective on the problem of knowledge that has captured Chomsky in a fruitless endeavor of explaining linguistic behavior in terms of knowledge. But the fact that persons can follow a rule does not imply that they have "knowledge" of it. A kingfisher does not know Snell's Law, even though it can discern the refraction of light through water; a computer does not know the English language, although it can direct a printer to write words; and, as Cooper (1975) has argued, our ability to count with natural numbers does not mean we unconsciously know Peano's axioms.

Chomsky's affiliation with Descartes leads him to postulate the existence of an innate knowledge of language. By way of contrast, Kant did not think that human beings know the categories simply because such concepts are not derived from experience. To learn such rules, the mind itself must become the object of investigation.

Chomsky and Kant

Chomsky supports his knowledge-of-language thesis with the writings of Descartes and Leibniz. While their work does bear a superficial similarity to Chomsky's, in particular the belief in innate knowledge, there also are some significant differences. Chomsky, for example, adopts a very different methodology from Descartes and Leibniz. Rather than seeking truth through intuition, Chomsky constructs mathematical models of linguistic skills in order to infer the nature of psychological structures and, like Kant (1787/1964), rejects the notion that the mind can be explained through the self-conscious reflections of the thinking ego.

Descartes believed that the veracity and immediacy of the cogito opened the way for an intellectual science of the mind, an enterprise that Kant (1787/1964) criticizes as the "fallacy of rational psychology." Self-awareness, Kant argues, does not tell us what kind of thing the "I" of thought is. In fact, Kant (1787/1964) believes it to be the "poorest of all intuitions" since it is "quite impossible by means of simple self-consciousness to determine the manner in which I exist" (p. 376). For Kant, the "I think," the transcendental unity of consciousness, must accompany all experiences. But if this unity is necessary for thought, the subject cannot detach itself from the intuition of the "I." The "I" must always be viewed through the categories, and in this respect it can have no more privileged status than any other empirical concept. For Kant, as for Chomsky, the mind must be found in the transcendental features of human experience. It is, to borrow Wittgenstein's (1921/1961) analogical pun, a case of the eye that cannot see itself!

As I argued in Chapter 2, Kant denied that empirical psychology could ever achieve the status of a science, since the phenomena of its inquiry--human nature--could not be captured in mathematical laws. The best that psychology can offer is a classificatory description of people's behavior based upon biographical, social, and anthropological studies. However, in contrast to this empirical or personal self, Kant posited a transcendental ego, a formal system of categories by which the mind structures the necessary and universal conditions of experience. In the Critique of Pure Reason, Kant (1787/1964) attempts to deduce this set of a priori concepts through a logical examination of consciousness that aims to demonstrate how all knowledge depends upon the structured mind.

It is this epistemology, I have argued, that provides the foundation for structuralism and its modern successor, cognitivism. Yet unlike Kant, structuralists reject all attempts to discern the nature of thought through a phenomenological investigation of consciousness. By adopting a naturalistic view of the mind, they seek to establish what Kant believed to be impossible, a scientific psychology of human nature. By investigating the regularities of an individual's thoughts and actions Lévi-Strauss and Chomsky aim to identify the universal structures generated by the human brain. In short, the thesis of the structured mind--advocated by both Chomsky and Lévi-Strauss--is simply Kantianism without a transcendental ego.

In an effort to undermine Chomsky's comparison of his own work and the ideas of 17th century rationalist thinkers, Cooper (1975) questions Chomsky's use of several common terms. That is, although Chomsky employs many of the same phrases as Descartes and Leibniz, Cooper demonstrates that in the context of his inquiries a radically different interpretation is being adopted. For example, when Descartes and Leibniz talk of universal truths, they aim to designate the concepts, principles, and ideas that find application in all conceivable circumstances, truths such as the propositions of mathematics and logic that are not contingent upon experience. In contrast, when Chomsky talks of a universal knowledge of grammar, he means to express a general acquaintance that each subject has with the laws of syntax. This sense of "universal" depends upon what is actually known by all individuals and thus is used by Chomsky to empirically demonstrate his thesis that the underlying rules of grammar are innate. For Descartes and Leibniz, on the other hand, truths could be universal even if nobody was ever aware of them, for their sense of the term turns on its logical character.

A similar confusion is evident in the use of the word "necessary." When Leibniz discussed necessity, he meant the logical necessity of knowing certain ideas or principles innately if knowledge is to be possible. But, again, for Chomsky necessity is an empirical condition, a consequence of his observations on the language acquisition model. This can be observed in the way that Chomsky proposes to test for such ideas, and how, even the very existence of deep structures becomes an a posteriori question. Yet, no amount of empirical evidence would be of the remotest interest to traditional rationalists. Their theory of innate ideas is derived deductively, not proven experimentally. In fact, both Descartes and Leibniz were careful to avoid any empirical elements in their arguments, since they were not trying to form a psychological explanation of ideas. Their considerations of the problem of knowledge were purely philosophical and could not rest upon contingent neurophysiological mechanisms. Such a criterion would always be open to disconfirmation and so could not provide the foundation upon which to erect the edifice of certain knowledge.

Chomsky's rationalism is also unlike that of Descartes and Leibniz in its objectives. They were concerned with the problem of knowledge and proposed the concept of innate ideas to account for the mind's ability to explain a separate and external reality. Chomsky is not a dualist and does not approach the mind with the same sort of concerns. Both Descartes and Leibniz placed ideas latently in thought in the sense that specific concepts must be developed through the proper exercise of reason. These ideas were not ready-formed notions stocking the mind like the garments in Locke's closet. But this is exactly the sense in which they must be present if Chomsky's thesis is to work. For to cognize grammatical laws implies that they must already be constructed in the mind.

Despite their different metaphysics, both Chomsky and Kant share the same objectives. Chomsky's efforts to explain the nature of mind through the language faculty--distributed among all individuals--parallels Kant's explanation of the understanding in terms of the categories. Further, unlike Descartes, both seek to put limits on what can be known. When Chomsky describes the parameters that define a grammar, he is charting the bounds of human comprehension. Indeed, in Language and Mind (1972) Chomsky expands this linguistic thesis and argues that biologically fixed modular cognitive capacities set limits on all forms of intellectual development from the ability to reason scientifically to the possession of an innate moral sense.

Just as one might expect a human child brought up by creatures with a radically different grammar to experience learning problems, so Chomsky (1972) argues that the elements of our innately shaped intellect can be charted by identifying those tasks that human beings find difficult. By way of example, he points to games such as chess, which he believes exist at the boundaries of our understanding. If chess was like language, he claims, there would be little point in our playing, since everyone would be an expert. The fact is that, by comparison, its relatively small number of rules can be applied better by those with superior intellectual skills at the edge of our common repertoire of abilities. As Chomsky recognizes, his thesis, like Kant's, implies that human beings may only know the world in a limited sense. The biological structure of the brain permits certain forms of understanding that may or may not correspond well with the nature of reality. In fact, echoing Kant, Chomsky (1988b) conjectures that our "current understanding at least suggests that the human intellect simply is not equipped to deal with certain kinds of questions, including quite possibly questions about human behavior" (p. 466). As Chomsky (1988b) recognizes,

> let me say that a lot of what I've just said could be reformulatd in Kantian terms. You could say that the structure of our experience and our understanding of experience is a reflection of the nature of our minds, and that we cannot get to what the world really is. (p. 468)

Both Kant and Chomsky look for the formal conditions of knowledge rather than a set of substantive ideas. Both see experience as mind dependent and search for systems of rules independent of content (the laws of syntax and the categories of thought). Both believe in the fixed limits of human reason and hold that the permanent faculties of mind shared by people in all societies are determined by our unique genetic inheritance. Moreover, each phrases his task in a similar manner. Kant (1781/1929) asks what must be the nature of mind, given the experiences we have. Likewise, Chomsky matches this Kantian turn with a revolution in linguistics that changes the focus of inquiry from the empirical task of recording different languages, to the project of inferring mental structures from the linguistic skills of the native speaker. It is similarities such as these that demonstrate that Chomsky's theory of generative grammar, like Lévi-Strauss's ethnography, is closer to Kant's epistemology than it is to the rationalism of Descartes or Leibniz.

One further similarity in the thought of Kant and Chomsky should also be mentioned. Although each one in their respective inquiries pursued highly technical and at times esoteric problems, both share a deep commitment to the practical consequences of their ideas. In Chapter 3 I described how both Kant and Lévi-Strauss endorsed Rousseau's vision of human freedom and how each, in a similar manner, attempted to establish the integrity of all societies through the primacy of mind. Chomsky (1988b) adds to this argument by undermining any authoritative agency that fails to recognize the moral worth of the individual. Having established linguistic creativity as the essential stamp of human nature and the rich genetic inheritance it presupposes, Chomsky (1988b) attacks political powers that cast the individual as a plastic, malleable being to be manipulated on the model of empiricism. In particular, Chomsky (1971) criticizes the "mandarins of Western imperialism" who have divorced value from intellect and blithely risk the destruction of the Third World in order to preserve the dominance of the West. Chomsky, like Lévi-Strauss, looks pessimistically towards the future and campaigns tirelessly for Rousseau's ideal society, where individuals will be emancipated from the dictates of the state and set free to follow the demands of reason. The construction of this utopian society, according to Chomsky (1971), is rooted in our understanding of language and mind.

> Language, in its essential properties and the manner of its use, provides the basic criterion for determining that another organism is a being with a human mind and the human capacity for free thought and self-expression, and with the essential human need for freedom from the external constraints of repressive authority. Furthermore, we might try to proceed from the detailed investigation of language and its use to a deeper and more specific understanding of the human mind. Proceeding on this model, we might further attempt to study other aspects of that human nature which, as Rousseau rightly observes, must be correctly conceived if we are able to develop, in theory, the foundations for a rational social order. (p. 394)

Chomsky's (1988) view of human nature thus turns on what at first sight might appear to be a contradictory equation: Individuals are free because they are biologically determined. As he explains, this basic characterization of human nature is the core of the rationalist view of life.

> I think myself that it is rationalist approaches which provide the basis for a progressive world view. . . . The rationalist view assumes that there are certain intrinsic properties of human nature, and we have to find out what those are. There is a line of development in traditional rationalism that goes from Descartes through the more libertarian Rousseau through some of the Kantians like Humboldt, all through the 19th-century libertarians, which holds that essential features of human nature involve a kind of creative urge, a need to control one's own productive, creative labor, to be free from authoritarian intrusions, a kind of instinct for liberty and creativity, a real human need to be able to work productively under conditions of one's own choosing and determination in voluntary association with others. (p. 594)

In Chapter 6 I will evaluate the philosophy of education that is sponsored by this Kantian thesis of the structured mind and its accompanying theory of value.

Conclusion

Chomsky has attempted to form a science of the mind by claiming that linguistics is an investigation of mental structures. What previous linguists regarded as an irreducibly social phenomenon, Chomsky has defined in terms of brain states. He argues that each individual is biologically endowed with a highly specific mental organ that grows in the brain in just the same way that physical organs grow in the body. In particular, the language module "matures," determining the syntactic structure of language quite independently of the content and nature of experience, just as a computer manipulates symbols without regard to their meaning. So in contrast to the traditional view that language acquisition and other forms of cognitive development are learning processes, Chomsky (1988a) believes that intellectual capacities simply unfold--as a plant would--through the triggering effects of the environment.

> Language learning is not really something that the child does; it is something that happens to the child placed in an appropriate environment, much as the child's body grows and matures in a predetermined way when provided with the appropriate nutrition and environmental stimulation.
> (p. 134)

As we will see in Chapter 6, this comparison of intellectual development with biological growth provides the scientific foundation for a modern statement of the romantic theory of education traditionally associated with the writings of Rousseau and Pestalozzi. Like these authors, Chomsky equates education with horticulture and believes that the teacher's task--like that of the gardner--is to nourish and protect in order to facilitate the unfolding of the child's biologically determined capacities. Just as a plant does not learn to be a flower from the soil it feeds on, so Chomsky (1988a) argues that "human development, including the development of language and thought" (p. 197), is not the product of experience.

Throughout this chapter I have rejected the nativist, modularist, and individualist assumptions of Chomsky's structured mind thesis by arguing that language has an objective existence in the historically evolving world 3 structures of a culture. I have argued that language exists prior to the subject and is publically constructed according to the needs and interests that define our form of life. I have criticized Chomsky's efforts to explain language as an innate biological property of the brain and have advanced the Popperian and Piagetian thesis that children learn to speak, just as they develop other intellectual abilities, through the application of general cognitive mechanisms. Such views, as I have tried to point out, are shared by many psychologists, linguists, and philosophers.

Moreover, in Chapter 6 I will argue that Peters's (1974) attack on the "education as growth" metaphor also undercuts the pedagogical implications of Chomsky's thesis.

The force of Chomsky's linguistic revolution, along with his personal influence on a generation of linguists, mask just how controversial his theories are. Yet there are other linguists, including several of Chomsky's former students, who have developed competing theories of grammar that rival the "master's" views for followers. As Gardner (1987) observes, Chomsky's approach to language is not as influential among professional linguists as much of the popular literature might seem to suggest. For example, many see in Richard Montigue's grammatical semantics much of the formal elegance of Chomsky's theory combined with a more convincing relationship between meaning and syntax (Gardner, 1987).

It is perhaps the relationship between syntax and semantics, Chomsky's autonomy thesis, that most critics find deeply problematic. In a passage quoted earlier, Lakoff (1980) identifies this methodological commitment as the "hard-core" and ultimate mistake of Chomsky's research program.

> Chomsky suggests that this view of modularity and innateness is grounded in empirical linguistic research. That is highly questionable, to say the least. The way Chomsky uses the modularity claim amounts to a matter of definition. The principal reason that Chomsky's views on the technical details of linguistics have shifted so radically is that he is trying to maintain his views on modularity in the face of mountains of evidence to the contrary. Perhaps the main reason that deep structures and transformations have disappeared is that it turned out to be impossible to both keep them and maintain the principal assumption of modularity: the independence of syntax. Most of the research showing this was done by a group of the first generation of Chomsky's followers: myself, Paul Postal, John Robert Ross, James D. McCawley, Robin Lakoff, Charles Fillmore, David Perlmutter, Edward Keenan, and others. What we found was that meaning and use (communicative function) effected virtually every rule of syntax in order to keep the central modularity assumption--the independence of syntax--Chomsky has progressively redefined and narrowed the domain of syntax so that rules that were traditionally part of syntax (e.g. case assignment, pronoun agreement constraints, the occurrence of negative polarity items) were redefined as being in "semantics"--that is, in a different module. Only by constant redefinition and narrowing of the facts for which the syntactic module is supposed to account has Chomsky been able to maintain modularity. (p. 23)

Even if lingusts do factor syntactic structures and semantic primes out of the normal flow of speech for the sake of analysis, it is not obvious that psychologists should follow suit. In describing linguistic behavior, it is important to recognize the illuctionary components implicit in all speech acts. Stress, intonation, and gesture can be observed in all natural forms of linguistic communication, yet they are ignored in Chomsky's analysis of mind.

> Message structure is an alternative conceptual framework for the study of language and communication, and the case for it involves a criticism of the Chomskyan notion of the deep structure of a sentence. In the initial Chomskyan account it was assumed that the meaning and structure of a sentence can be analysed in vacuo. A sentence, however, is only the medium for an assertion and as Rommetveit has demonstrated can be the medium for various assertions or messages, depending upon the context in which it is uttered and the intention of the people who utter it. (Sampson, 1981, p. 184)

In Chapter 3 I argued that Lévi-Strauss's analysis of myth failed to capture the fundamental character of mind because it ignored the content, desires, aims, and wishes that motivate social forms of expression. Chomsky's computational theory of syntax commits the same mistake. By reducing the structure of language to a set of mathematical laws, similar to a computer program, Chomsky can construct formulas that mimic one element of human speech. But such automita, as Descartes observed, cannot engage in conversation with ordinary people, for it is the meaning implicit within a sentence that determines how it should be spoken. And this relationship, as history shows, changes in unpredictable ways with the ever-evolving forms of life that define human experience.

More socially minded philosophers of the human sciences, like Margolis (1984) and Manicas (1987), support interactionism and Popper's world 3 view of language as an independent construct that is irreducible to the psychological states of individual speakers. They maintain that language, like other social structures, attains emergent properties that are captured in a network of public conventions. While this objective corpus of rules is not a purposeful product--people do not agree to direct the development of language--nonetheless, its historical evolution is a consequence of the myriad activities of individual subjects. So while psychology must study the structures and processes that constitute mental life--perception, cognition, emotions, motivation, learning, and so on--such physiologically oriented inquiries should be accompanied by the recognition that human actions also are intractably impregnated with the cultural context of life. As Margolis (1986) explains, the "new psychologies" they advocate

> are bound to be top-down, commited to a strong view of the emergence of language and culture as sui generis phenomena, committed to that version of methodological individualism that concedes the irreducibility of the societal to the individualistic, committed to construing psychological properties as incarnate (hence, linking biology and culture), opposed to the unity of science program though not to whatever unity may be associated with a descending continuum of explanation, committed to the rejection of a homonomic reading of the sciences unless that reading is applied to the most complex order of phenomena, and committed to the intensional complexity of intentional contexts. That is already to say a great deal. A psychology that meets these conditions would be radically different from the exemplars that have prevailed primarily in the Anglo-American tradition and rather less opposed to those that have prevailed in the Continental. . . . We may say that the entire societal orientation within which individual psychology is to be examined is itself subject to radically contingent historical change. This may well be the most heterodox element of the new psychologies. Its direct consequence is, quite simply put, that the study of the psychology of individuals is inseparable from the study of their societal milieux and that that study is not and cannot be the study of an essential human nature. The theme of the new psychologies, we may venture, will be, that man's "nature" is his history. (pp. 47-48)

Chomsky has proposed an inadequate view of the mind by comparing his postulated syntax module with a bodily organ. Such metaphors are both misleading and simplistic. Surely the functions performed by the brain are of a vastly different order to those of the heart or the liver. Its development, unlike other parts of the body, cannot be explained through the environmental triggering of a preformed structure, a fact that is evident from the intentional nature of human thought, for all concepts, language, and perceptions are inextricably tied to the interests, desires, and purposes that constitute social existence. Chomsky's attempt to separate syntax from semantics is as ill-conceived as his efforts to compare the development of linguistic competence with the maturation of a plant from its seed. In both the social and the individual domains the structure of language must be understood in terms of the historical attempt to communicate meaning, a fact of life, which as Margolis (1984) recognizes, does not square with Chomsky's efforts to explain the mind through biology.

> If . . . Chomsky were (and could be shown to be) mistaken in supposing that the grammar of a language can be pried apart from its semantic features--so that a genetic and biologically developmental account can be suitably given of that module of a language--and if he were mistaken in supposing that the grammatical and

semantic features of a language can be prised apart from the entire range of nonlinguistic experience acquired contingently, diachronically, and variably, then the full import of insisting on the consensual nature of the human sciences would be easily confirmed. Certainly, the notion that language is essentially or primarily like an internal organ of the body would be exposed as the profoundly misleading image that it is. (p. 87)

CHAPTER 5
PIAGET

Introduction

Although history may well remember Piaget as a child psychologist, his theoretical priorities always have centered on the need to explain the process of development in all forms of life. In particular, since he regards knowledge as an instance of cognitive adaptation, he seeks to explain the development of mind, from the most primitive biological structures to the level of abstract reasoning (found in mathematical thought), through a single logic of structural organization. For this reason he claims the title of genetic epistemologist and supports the uncommon intellectual pedigree of being both a philosopher and a biologist. His work in child psychology, although occupying him for some 40 years, was undertaken with the simple aim of studying the conditions that make knowledge possible, that is, that links the objectivity of thought to its mode of construction.

While the development of concepts can be analyzed in the history of ideas, the remoteness of prehistoric thought limits the scope of such an inquiry. The central claim of Piaget's (1950) epistemology is that this historical study can be completed by investigating how the individual subject constructs concepts psychogenetically. Yet, despite popular interpretation, Piaget (1926/1973) does not mean to state the literal thesis of the biogenetic law that ontogeny recapitulates phylogeny. As he cautions, "let us guard against returning to the simplistic idea of a necessary parallelism between the development of the race and that of the individual, a parallelism which biologists have shown to be equivocal and conjectural" (p. 204).

Initially Piaget (1926/1973) conceived the relationship between histogenesis and psychogenesis as that of the universal to the particular. The process of adaptation at work in conceptual history also can be observed in the individual. "The elimination of realism, of substantialism, of dynamism, the growth of relativism. . .are evolutionary laws which appear to be common both to the development of the child and scientific thought" (p. 240). So by examining how the subject constructs new ideas to overcome the limitations of a given conceptual scheme, the psychologist can complete the details of the historical construction of mind.

Through these studies Piaget identifies many interesting symmetries and partial isomorphisms. For instance, the child's development of the concepts of number, causality, and force seem to follow the same path as their historical counterparts. Such parallels have convinced Piaget that the same logic of development must underlie all thought, even in the apparently anomalous case of spatial understanding where the child's acquisition of geometrical concepts, from topological to Euclidean space, reverses the historical sequence. Accordingly, in the second half of his career Piaget turns from investigating the content of thought--the particular concepts acquired in cognitive development--to the task of formalizing a universal law of adaptation that will explain evolutionary growth in all domains through a single theory of organization.

Many commentators (e.g., Hamlyn, 1979; Kitchener, 1986) conveniently have labelled Piaget a developmental Kantian and interpreted his empirical studies as a form of transcendental psychology, that is, as an attempt to chart the necessary stages in the formation of the categories that make knowledge of the world possible. While this serves as a basic orientation, I will argue that Piaget's genetic epistemology is much closer to Hegel's philosophy of spirit, in that both share a belief in the rational construction of reason through a dialectical logic of experience.

Rotman (1977) identifies this common commitment but fails to complete the comparison.

> For Piaget, then Kant's description of human reason is only a stage within a larger development. Like Hegel, Piaget places Kant in a temporal context as a moment within the historical development of reason. But unlike Hegel, for whom reason was the means and the result of human self-consciousness and who had little use for any biological view that placed it outside of human intentions, Piaget's interpretation is an evolutionary one. (p, 29)

As I argued in Chapter 2, Hegel's epistemology _is_ based upon a biological concept of development--_bildung_--that directs spirit from its initial phenomenalism to an awareness of itself immanent in the world it creates. This also is true of Piaget's (1918/1977) earlier writings, where, in contrast to the technical character of his better known psychological studies, he proposes a reconciliation between religion and science and develops a theory of value based upon his evolutionary view of life.

Before exploring these points of similarity, a working knowledge of Piaget's ideas and his intellectual background must be acquired. We need to meet Piaget the epistemologist, biologist, mathematician, logician, philosopher, and psychologist. For Piaget writes as a polymath, with a vision of a grand synthesis that will explain all forms of life through a single process of adaptation. This conviction, manifest throughout his writings, has driven Piaget to being one of the most productive theorists of all time, publishing more than 50 books and 300 articles on a panorama of topics. However, as critics like Phillips (1987) complain, much of Piaget's prose is convoluted and obscure. Further, since he invents and continually redefines technical terms, it often is difficult to compare the meaning of his ideas among different subjects. Perhaps for this reason, many persons seem content to accept the insights of his psychological studies without following his esoteric and highly abstract arguments across the entire spectrum of human knowledge. Yet without a more comprehensive view of Piaget's thoughts, the objectives that motivated his inquiries will be lost in the detail of his research. So rather than detailing the specifics of his psychological findings, I will explore those concepts and ideas that best represent the overall purpose of his work. In particular, an effort will be made to showcase the constructivist nature of Piaget's epistemology in order to compare his Heglian notion of a developing mind with the Kantian conception of a structured intellect framed by Lévi-Strauss and Chomsky.

In the first half of this chapter I will trace the development of Piaget's thought and discuss his structural psychology of mind. I shall then present and evaluate Piaget's epistemological thesis. Finally I will conclude by rejecting Piaget's internal logic of history, demonstrating that his equation of knowledge with cognitive structure seriously misrepresents the social character of thought.

The Development of Piaget's Thought

Even as a boy Piaget was extremely studious. An exceptionally intelligent and creative child, he wrote his first scientific paper at the age of 10. In fact, the young Piaget became such an authority as an amateur malacologist that, when only 15 years old, he was offered the position as curator of the mollusk collection at the Geneva Museum of Natural History. As Piaget (1952) remembers in his autobiography, he had to decline the post since he still had two years of schooling before him! In fact, while in his teens Piaget published 25 papers on his observations as a naturalist, and although these reports cannot be ranked among his more serious studies, they did provide an insight into the scientific method and a sense of stability with which to face the intellectually and emotionally traumatic period of his adolescence.

To temper this obsessive scientific specialization, Piaget's godfather introduced him to Bergson's Creative Evolution (1907/1944). This text was to have a considerable influence on Piaget's theoretical interests. For now his attention turned away from the practice of science to the more general question of how knowledge itself is possible. As Piaget (1952a) remembers, in Bergson he saw the seeds of a biological philosophy that could explain the growth of mind in evolutionary terms.

> It was an emotional shock. I recall one evening of profound revelation. The identification of God with life itself was an idea that stirred me almost to ecstasy because it now enabled me to see in biology the explanation of all things and of the mind itself. (p. 239)

The intellectual force of this realization, that all human phenomena could be explained through the process of biological evolution, convinced Piaget to devote his life to determining the genesis of knowledge. Yet unlike Bergson, Piaget (1952a) did not believe this task could be achieved through philosophical inquiry, and he resolved to construct an experimental study of mental adaptation through psychology. Further, since Piaget's earlier zoological inquiries had taught him to be suspicious of the Darwinian thesis and explanations based upon chance, he sought a more interactionist model of development. Bergson, while accepting the principle of evolution through post hoc selection, rejects all efforts to construct a logic of development. The whole, he argues, is greater than the sum of its parts, and a science that deals with the simple amalgamation of elements cannot formalize a living unity in mathematical terms. Development depends upon a creative impulse, an elan vital, that directs systems in all spheres--from biological organisms to social organizations--toward greater degrees of adaptation and freedom. In contrast, Piaget, like Hegel, was convinced that any theory that leaves development to chance can only foster irrationality. His goal, also shared by Hegel, was to find a third way between mechanism and vitalism through a concept of growth based upon the logic implicit in action. Further, in concert with the structuralist enterprise, Piaget proposed a naturalistic concept of life and attempted to capture all forms of development in a scientific theory sensitive to the character of the whole as an integrated unity of its parts.

While studying for his baccalaureate degree, Piaget attended classes in psychology, logic, and the history of science at the University of Neuchâtel given by the Swiss philosopher Arnold Reymond. (It is interesting to speculate that Reymond's interest in the "logic of wholes" may have been stimulated by Saussure's 1911 lectures at the nearby University of Geneva.) From these meetings, Piaget (1952) formulated the concept of an interactive structure that could represent the organizational relationship he sought. All forms of life, he concluded, are defined by governing totalities that order parts within a unified system. In his autobiography, Piaget (1952a) recalls how he first introduced this theory in an unpublished paper titled "Sketch on Neo-Pragmatism."

> I presented an idea which has since remained central for me, namely, that action in itself admits of logic (this contrary to the anti-intellectualism of James and Bergson) and that, therefore, logic stems from a sort of spontaneous organization of acts. But the line with biology was missing. A lesson with A. Reymond . . . gave me a sudden insight. I suddenly understood that at all levels (viz., that of the living cell, organism, species, society, etc., but also with reference to states of consciousness, to logical principles, etc.) one finds the same problem of relationship between the parts and the whole; hence, I was convinced I had found the solution. In all fields of life. . .there exist "totalities" qualitatively distinct from their parts and imposing upon them an organization. Therefore there exist no isolated "elements;" elementary reality is necessarily dependent on a whole which pervades it. (p. 241)

It is worth pausing to consider this pivotal insight. For in hindsight it is possible to see in this intellectual intuition the central themes that directed his life's work. As with so many other great thinkers, Piaget's entire oeuvre can be considered an attempt to work out the details of an adolescent vision. This task, anticipated by Bergson (1907/1944), was to link philosophy and biology by establishing a science of genera. Like Hegel, Piaget sought to identify and explain the emergence of "systems" from the basic biological structures of nature to the holistic organization of society pictured by Durkheim. As Michael Chapman (1988) explains this project,

> Bergson had realized that the problem of universals recurred in modern psychology in the form of accounting for the origins of general ideas and in biology in terms of explaining the unity of individual organisms and their classification in genera and species. For the young Piaget, genera came to be conceived as the basic forms of organizations in all life, from the structures of the human mind to the structures of the living organism. The originality of this approach consisted mainly in the fact that the problem of universals was transformed into a program of scientific research. As forms of knowing, genera could be investigated through psychological methods, and as forms of life they could be objects of biological study. Moreover, a developmental continuity was seen to exist between human cognition and other levels of biological organization. (p. 5)

Piaget (1952a) argues that the set of possible interactions between parts and wholes defines three sorts of equilibrated systems: (a) the continuity of the whole achieved through the flexibility of the parts, (b) the maintenance of the parts through the changing whole, and (c) more "satisfactorily," the reciprocal adaptation of parts and whole in order to preserve the functional integrity of the system. This latter organization, he believes, represents the ideal form of equilibrium to which other structures aspire.

Piaget employs this hierarchy of genera not only to explain biological and conceptual structures, but also to "prove" the superiority of certain moral, religious, and social systems. In essence, he argues that questions of value can be addressed by investigating the psychological structures that support judgment (Chapman, 1988). Adaptation progresses toward more stable states of equilibrium, so the system that best relates the whole with its parts should yield superior decisions. For example, Piaget (1932/1965) proposes a third alternative to the Durkheim-Tarde debate over holism and individualism in the human sciences. Durkheim, who saw cultural facts as irreducible wholes, argued that explanations based upon the actions of individuals could not account for social behavior. Tarde, following Mill, took the opposite line and claimed that social action indeed can be reduced to psychology. Piaget thus rejects both Durkheim's whole over parts and Tarde's parts over whole models in favor of a view of the whole as the sum of its parts plus all the relations between them. As Piaget recalls in an interview with Vonèche (1982),

> Under the influence of Durkheim, which was after all immense in France, I wasted a fantastic amount of time trying to decide between the social and the individual. That lasted up until the moment I realized that cooperation could be spelled "co-," "operation." When the Durkheimians put the whole burden on society, they commit the incredible mistake of forgetting that, without the nervous system, nothing at all would happen. (p. 84)

Yet, as we will see throughout this chapter, Piaget's solution--"relationism"--while avoiding the reduction of social phenomena to psychological laws, remains fundamentally individualistic, committing the opposite mistake to Durkheim's holism, the neglect of the social.

Besides his schoolwork, Piaget read deeply in philosophy and the social sciences. In study he found a respite from the emotional troubles and conflicts of his home life. Moreover, as a young man growing up in a continent ravaged by war, he was deeply affected by what he saw as the madness and irrationality that had engulfed Europe. In several early papers he presents passionate pleas for socialism (Piaget, 1915/1977; 1917/1977; 1918/1977). He believed that a blind conservatism, inherited from an outmoded era, had propagated the "vices" of nationalism, pride, and egoism. These "evils," he argues, serve only to crush the human spirit by establishing hypocritical social and religious institutions. All around him he watched the senseless absurdity of a life controlled by authority and dogma. Social injustices, prejudice, war, poverty, the oppression of women, and even the monotony of life, he complained, were a manifestation of these archaic attitudes. In their place he proposed "love and altruism" as the basis for a new social order that would match the zeal of the Bolshevik uprising without falling into the terror of the French Revolution (1915/1977, pp. 27-37). The emotional stress of all these ideas and pressures became too much for the intellectually sensitive Piaget and finally culminated in a breakdown due to nervous exhaustion.

Piaget then spent a year recovering in the Swiss Alps. This was to be a spiritual as well as a physical convalescence, the fruition of which was his philosophical novel Recherche (1917/1977). Meaning "search" or "research," the novel was the semi-autobiographical story of a young scientist beset by the crisis of a world at war and the confusions of his own religious skepticism. By returning to his studies, the hero, Sebastian, recognizes in the science of genera the logic immanent in life and proceeds to establish a new faith in the power of reason derived from the biological process of adaptation. It was a vision of a new mode of life based upon knowledge rather than dogma, a rejection of otherworldly metaphysics for a scientific socialism, where both the laws of nature and society could be determined by reason. Although couched in emotive terms, this theme of reason evolving rationally, through an adaptive process, was to be a central tenet of Piaget's future research, just as it had been for Hegel in the emergence of spirit. As Chapman (1988) observes, it is fascinating to see how these early philosophical writings anticipate the scientific concepts that became the basic themes in Piaget's later studies.

> Three ideas in particular have been identified as stemming from his early philosophical system: first, the idea that action lies at the basis of thought, but that action itself is characterized by a certain logic, or structure; second, the idea of genera as relational totalities underlying organization at all levels of life, from the cell to the highest levels of human though and society; third, the idea of equilibrium as the dynamic form of development at all levels. One is astonished to think that these ideas animated Piaget's work from beginning to end, although they were conceived before it ever occurred to him to investigate cognitive development in children! (pp. 29-30)

On returning to Neuchâtel, Piaget quickly immersed himself in study, and with a renewed vigor completed his doctorate in zoology. (He also studied mathematics at this time, paying special attention to group theory, which, as we shall see, was to play an important role in his logical description of holistic structures.) Upon his graduation he journeyed to Zurich and worked as an assistant in several psychological laboratories. This was a year of frustration. The tasks to which he was appointed seemed to have little relevance to his earlier insights, and the lectures on psychoanalysis he attended only convinced him of his obsessiveness with his youthful goals. Pledging to put his ambitions behind him, Piaget decided to continue his studies and enrolled at the Sorbonne for two years. Here he attended lectures on pathological psychology, logic, and the philosophy of science. During this time he met Leon Brunschvicg, for whom, Piaget (1952a) recalls, he had the greatest intellectual respect. From Brunschvig's teachings Piaget learned the historico-critical method of analyzing concepts and gained an insight into how psychology may be related to philosophical and scientific questions.

It is interesting to observe how many of Brunschvicg's ideas became integrated into Piaget's emerging epistemology (Copleston, 1977). Like Cournot and Renouvier, who Piaget had also read (Chapman, 1988), Brunschvicg was concerned with putting Kant's philosophy in a developmental setting. Brunschvicg did not believe that the categories of thought could be discovered through an a priori deduction. The history of scientific ideas had shown how human creativity motivates the invention of new concepts to attain a greater degree of unity within experience. According to Brunschvicg this was particularly evident in modern physics, which constructed bold new ideas of space and time to transcend the limitations of the traditional Newtonian concepts. Since the apodictic truth claimed by Kant had been undermined by new, unforeseeable experiences, it was up to the imaginative mind to construct novel categories to render the world intelligible. Only through this historical process of facing and resolving problems, of bringing experience and concept together, can spirit develop. This is why Brunschvicg, before Piaget, studied the emergence of mind through the growth of scientific and mathematical concepts.

Like Hegel, Brunschvicg also criticized Kant's subjective idealism. He believed that the commonsense perspective of naive realism, in which an independent external world is presented against a thinking ego, can be raised to a "philosophical" standpoint when it is recognized that the subject-object distinction itself is formulated within consciousness. The world exists through our knowledge, and mind comes to self-consciousness of itself when, as for Hegel, it recognizes that reality is of its own making (Copleston, 1977, pp. 172-176).

In Paris things started to fall into place for Piaget. He was recommended to Theodore Simon and offered a post standardizing Alfred Binet's early intelligence tests on Parisian children. During the two years of this study, the main themes of his youthful philosophy were maturing into more precise concepts. In the mornings he read logic at the Bibliotéque Nationale and in the afternoons continued his interviews with children. However, rather than conducting the standard question-answer format that the intelligence test required, Piaget engaged his subjects in a more interactive dialogue patterned after the method of psychiatric questioning. Although not initially excited by this project, Piaget found himself with the freedom to conduct these interviews according to his own design. His mood soon changed, for in the typical errors of reasoning that children made in response to his questions, he observed the use of qualitatively different sets of logical principles from those employed by adults. This was the first empirical confirmation of Piaget's (1952a) theoretical relationism:

> Thus my observations that logic is not inborn, but develops little by little, appeared to be consistent with my ideas on the formation of the equilibrium toward which the evolution of mental structures tends; moreover, the possibility of directly studying the problem of logic was in accord with all my former philosophical interests. Finally my

> aim of discovering a sort of embryology of intelligence fit in with my biological training; from the start of my theoretical thinking I was certain that the problem of the relation between the organism and the environment extended also into the realm of knowledge, appearing here as the problem of the relation between the acting or thinking subject and the objects of his experience. Now I had the chance of studying this problem in terms of psychogenetic development. (p. 245)

Whatever the merits of Piaget's theory, he must surely be remembered--after Rousseau--as the first person to have experimentally explored the implications of one of the most obvious but often neglected facts of daily experience, namely, that children reason in very different ways than adults. By establishing a scientific study of the development of human thought, Piaget fused epistemology with psychology and demonstrated that problems of knowledge are related to their mode of construction. The mind for Piaget, as for Hegel, is not determined by a priori structures but emerges through the subject's interaction with the environment. In short, for both thinkers, reason must be studied genetically through its psychological and historical origins.

Piaget published his findings from these studies in three papers, the third of which he presented to the famous child psychologist Edmond Claparède. Claparède was so impressed with the article that he offered the 25 year-old Piaget the position of Director of Studies at the Maison de Petits, the now world-renowned Institut J.J. Rousseau in Geneva. This was the start of Piaget's intensive study of psychology. Extending his Parisian inquiries to fill five monographs--charting children's developing conceptions of reality--Piaget won immediate international acclaim, both for his theory and the subtlety and inventiveness of his methods (Chapman, 1988).

Piaget soon recognized two limitations in these works. First, in his investigation of infant behavior he realized that he had overestimated the role played by language in early thought. Originally believing that verbal responses correctly match intellectual comprehension, Piaget had categorized children's logic on the basis of oral responses to spoken questions. However, as his subsequent studies demonstrate, young children can solve problems at an earlier age when they are allowed to manipulate objects. Indeed, this time lag between the ability to act--know how--and the capacity to provide reasons for behavior--know that--continued to interest Piaget throughout his career and provides the topic for two of his most recent psychological works, Success and Understanding (1978) and The Grasp of

Consciousness (1976). Second, since Recherche, Piaget has recognized that the structures of thought he aims to formalize can be identified by the principle of non-contradiction, which he believes is the mark of psychological equilibrium. Since such logical systems depend upon the construction of reversible operations--mental rules that preserve the properties of thought--Piaget sought to describe the developing mind in terms of a series of invariant transformational structures. Yet despite his efforts he was unable to formulate a satisfactory mathematical model of an equilibrated system.

Piaget (1952a) found the answer to both of these problems in a fuller investigation of the young child's practical activity. This focus on the personal construction of intellectual operations through the logic of action marks the emergence of Piaget's mature thesis. Even so, it is interesting to observe just how much of Piaget's later theory was prefigured at this stage. He sums up his early investigations in The Judgment and Reasoning in the Child (1928):

> In conclusion, we may say that the first stage of childish reasoning is that of primitive or irreversible mental experiment, that the second is distinguished by a beginning of reversibility in the mental experiments, and that the third stage is marked by the appearance of formal deduction and logical experiment, the latter alone being capable of rending the mental experiments completely reversible. Or again, we can say that during the first stage the reasoning mind does no more than to "imitate" reality as it is, without reaching any necessary implications; during the second stage the mind "operates upon" reality, creating partly reversible experiments and thus reaching the consciousness of implication between certain affirmations and certain results; finally, in the third stage, these operations necessitate each other in the sense that the child realizes that by asserting such and such a thing he is committing himself to asserting such and such another thing. He has at last attained to necessary implication between the various operations as such, and to a complete reversibility of thought. (pp. 194-195)

During his first few years in Geneva, Piaget (1952a) became acquainted with the Gestalt school of psychology. Unlike behaviorism, which stressed learning through the association of atomistic sensory experiences, researchers like Kohler and Wertheimer emphasized the constructive role of the mind. Starting from the sense of wholeness that characterizes perception, they attempted to explain experience in terms of the forms imposed upon the world by our intellectual processes. While Piaget was greatly encouraged that a notion of structural totalities had found application in these psychological studies, he nonetheless criticized and then rejected the Gestalt perspective.

In contrast to his own concept of a fully compensating system, Gestalt structures corresponded only to the limited form of equilibrium in which the whole strictly dominates its parts. While recognizing the existence of such structures in perceptual systems, he maintained that they failed to capture the complexity of cognitive processes. Piaget's project was thus to find a genetic nesting of emerging logical structures that would approach the ideal form of equilibrated organization characteristic of rational thought. From his meticulous studies of his own children, Piaget observed a continuity between the logic of practical activity and that of abstract thought. Since he had already recognized that the subject's developing conception of the physical world can be explained through Poincaré's analysis of spatial displacements, Piaget (1937/1971) concluded that intellectual operations must correspond to the same mathematical structure. This was a pivotal point in Piaget's structuralist theory of mind, for he now possessed the logical apparatus he needed to chart and describe the various stages of cognitive development in terms of underlying competence structures.

Poincaré had shown that the transportation of objects in space defines a "mathematical group." (I will discuss this construct more fully when I consider Piaget's psychological studies.) Since he also believed that human beings possess a Kantian-style intuition of this structure, Poincaré was able to explain the necessary application of geometry to experience. While the implicit reversibility of operations within the group concept provided Piaget with a perfect model of an interactive organization, he rejected Poincaré's a priori view of the mind. Instead, in books like The Origins of Intelligence (1936/1963) and The Construction of Reality in the Child (1937/1971), Piaget carefully explains how the subject gradually constructs a conceptual group-like representation of the world. The same physical properties that first are met in the infant's initial explorations are intellectualized in cognitive schemes and mental operations during the course of development. According to Piaget (1936/1963), the psychological construction of the mind has three distinct phases. In the first period, "sensorimotor" intelligence, the child's thoughts are tied to the manipulation of physical objects. During the stage of "concrete operations" the child learns to conceptualize the properties of physical objects though thought remains dependent upon perceptual characteristics. Only at the period of "formal thought," where operations become completely abstract, does mature propositional reasoning, independent of reality, become possible. In charting the construction of this intellectualized group of operations, Piaget invented and applied several other mathematical constructs. By employing "lattice," "grouping," and group structures, Piaget provides a formal description of the logical properties that underlie the development of the mind. This mathematical account of psychogenesis is explained fully in The Psychology of Intelligence (1947/1950).

This text is important for three reasons. First, it provides a complete statement of Piaget's psychological theory. Second, it initiated a period in Piaget's intellectual life in which he attempted to phrase a clear statement of his own epistemological views in contrast to other theories of knowledge. Third, having completed his taxonomic analysis of thought, Piaget changed focus in this book from his initial concern with structure to the study of functions. Now Piaget's interests turned toward providing a scientific explanation of how the mind develops through the various stages he had identified. This project can be seen in Piaget's (1947/1950) description of the aims and methods of psychology.

> The psychological explanation of intelligence consists in tracing its development and showing how the latter necessarily leads to the equilibrium we have described. From this point of view, the work of psychology is comparable to that of embryology, i.e., a work which, in the first instance, is descriptive and which consists in analyzing the phases and periods of morphogenesis up to the final equilibrium constituted by adult morphology, but this study become "causal" once the factors which ensure the transition from one stage to the next have been demonstrated. (pp. 48-49)

Over the 20 years that followed his initial Geneva studies, Piaget continued his investigations into the psychogenesis of thought. With his longtime colleague, Barbel Inhelder, he published works on the child's conception of number, quality, velocity, time, space, movement, probability, and logic. Throughout this period he also maintained an impressive teaching commitment, lecturing in philosophy, the philosophy of science, psychology, and sociology. Moreover, as Piaget (1952a) recalls, this was also a period of rigorous study. He continued his early biological inquires, and, for ten successive years, immersed himself in the history of science to discover the development of the central concepts of mathematics, physics, and biology.

Piaget composed his magnum opus, the three volume Introduction à L'Epistemologie Genetique (1950) to combine these areas of thought into a single statement of the problem of knowledge. It is regrettable that this overall personal perspective on his life's work has never been translated into English. The problem most Anglo-Saxon thinkers face in synthesizing Piaget's extensive oeuvre is forming a sense of the underlying continuity and direction that tie his many projects together. How does psychology inform epistemology? What is the relationship between sociology and psychology? Why should mathematics be regarded as the most perfect form of biological evolution? All these questions and many more are addressed in this text, to which I will return later in this chapter.

The central theme in the Introduction is to elaborate a scientific theory of knowledge. In Piaget's view, epistemology has now come of age as a discipline and finally--like other subjects--can be emancipated from the intuitions of philosophers. Questions of knowledge, he argues, cannot be answered through speculation, but must be solved by empirical verification. For Piaget, as for Lévi-Strauss, this is as much a personal conviction as it is a theoretical position. In his semi-autobiographical Insights and Illusions of Philosophy (1965/1972), Piaget traces his own progressive disenchantment with philosophy. Criticizing both its dependence upon the socio-political climate and the trenchant attitudes it fostered (Piaget characterized many of his debates with philosophers as "dialogues with the deaf" (Chapman, 1988, p. 260)), he sought to put epistemology on a scientific track toward "the truth." Piaget (1965/1972) argues that philosophy, as its name implies, is concerned with the coordination of values and the pursuit of wisdom. Only science, which deals in facts, can determine the truth or falsity of claims to knowledge.

> When it is a question of metaphysical problems involving the coordination of values judged to be of essential importance, problems which thus introduce factors of conviction or faith, speculative reflection remains the only method possible; but remaining bound up with the whole personality of the thinker, it can only lead to a wisdom or rational faith, and is not knowledge from the point of view of objective or inter-individual criteria of truth. When it is a question, on the other hand, of the more delimited or delimitable problems of epistemology, then an appeal to facts or to logico-mathematical deduction becomes possible: the historico-critical method of my teachers Brunschvicg and Reymond, the psychogenetic analyses of the formation of concepts and operations, the logical analysis of the foundations of mathematics, provide methods of testing that individual reflection is unable to provide. (p. 12)

Just as Piaget had identified many of Europe's social problems with the dogmatism of "armchair" thinkers in his youthful novel Recherche, so he observed an equal lack of intellectual integrity in the academic world. This was particularly evident in the French university system. After succeeding Merleau-Ponty at the Sorbonne, he found it impossible to convince his colleagues that epistemology could be an empirical study and was continually encouraged to develop a philosophical psychology along the lines of Sartre's theory of emotions (Chapman, 1988). For Piaget (1965), such "speculation" produced the most pernicious kind of theory that impeded progress while preaching its own successes. In its place he campaigned for interdisciplinary cooperation and returned to Geneva to promote research among subject specialists invited from around the world.

In his later writings, Piaget attempted to formalize the relationship he had postulated as a young man between biology and intelligence. His psychological studies, while revealing a series of universal cognitive stages, reinforced his conviction that a single law of development underlies the formation of all structures. For Piaget this mechanism--the process of equilibration--extends to life in all its variegated forms. As he explains his hypothesis in Biology and Knowledge (1967/1971),

> cognitive processes seem, then, to be at one and the same time the outcome of organic autoregulation, reflecting its essential mechanisms, and the most highly differentiated organs of this regulation at the core of interactions with the environment, so much so that, in the case of man, these processes are being extended to the universe itself. (p. 26)

For Piaget, life can be defined by the intrinsic need to find a balance with the environment. From the most basic organic processes to the ultimate achievement of mathematical knowledge, all action is directed toward the command of a more stable equilibrium. (Following Brunschvicg, Piaget (1967/1971) believed that mathematics was the most advanced level of thought. Through its differentiation of form and content, it makes the ideal model of an adapted structure, capable because of its universality of compensating for all contextual changes in the environment.) Like Hegel, Piaget sought to explain purposive development without invoking Aristotelian final causes or a Bergsonian vitalistic will. His solution--equilibration--is a dialectical law of progress, which follows a "vector" quality within experience and leads cognitive structures toward a greater degree of objectivity.

Piaget believed that he had found the key to this synthesis of mathematics and biology in Waddington's (1975) theory of evolution. Waddington, writing within the Darwinian tradition, sought to explain the adaptation of a species in terms of the sympathetic environment it creates through its own behavior. The resulting "epigenetic system" develops through a progressive or "homeorethic" equilibrium as autoregulation mechanisms transfer information between the genome and the phenotype. The bicausal feedback circuits this model suggests provided Piaget with the logical apparatus necessary for the functional component of cognitive growth. Yet, as I will argue later in this chapter, Piaget's attempt to employ such concepts--which were developed to understand how populations adapt--to describe an individual's intellectual growth remains fundamentally problematic.

With the conviction that cybernetic models can provide a mathematical expression of the equilibration process, Piaget continued in his efforts to refine the relationship between structures and functions. His last major psychological work, The Development of Thought (1977a), is an attempt to provide a causal explanation that frames the mechanisms of intellectual adaptation in terms of the need to compensate for contradictions generated by existing schemes. This theory, genetic constructivism, thus fuses structure and function in a dialectical logic of action to explain the growth of reason as a rational process causally initiated by the subject's activity in the world. Under such an integration the synchronic and diachronic aspects of development will be seen just as particular abstractions from a unified whole, which as von Bertalanffy (1968) suggests, may only serve to conceptually mask the underlying continuity of life. "In the last resort, structure (i.e., the order of parts) and function (the order of process) may be the very same thing, in the physical world matter dissolves into a play of energies, and in the biological world structures are the expression of a flow of processes" (p. 27).

The Psychogenesis of Thought

Piaget's Theory of Value

Although most commentators try to place Piaget's psychological research in context with his epistemological theory, few have attempted to examine how the moral, religious, and political issues he faced as a young man influenced his thought. When these questions are considered, The Moral Judgment of the Child (1932/1965) can be seen as a watershed in Piaget's life. For at this point in his career, Piaget establishes an important philosophical synthesis of his practical and intellectual concerns that provides an orientation for his studies on the problem of knowledge. This position can be characterized as "immanentism," a theoretical and religious view of life that in many respects parallels Hegel's notion of spirit.

Like Kant, Piaget's fundamental concern is to establish a system of thought that will reconcile faith with science. For Piaget this is not an academic exercise. These themes had been played out in the conflict between his atheistic father and his devoutly religious mother, and again in the emotional tension he experienced balancing his interest in the natural sciences with his own commitment to God. In particular, he sought a third way between what he viewed as two extreme positions: the transcendent notion of God encapsulated in church dogma and the conception of life incorporated in positivistically-oriented biology. Piaget's solution was to identify Bergson's élan vital as an evolutionary drive within the sphere of human values leading men and women toward higher forms of moral consciousness. Piaget believed that the end of this historical process was a society where individuals reject the otherworldly teachings of the church and the divinity of Christ in favor of finding moral goodness by emulating the life of Jesus (Vidal, 1987). Piaget first introduces this "Bergsonian Protestantism" in an emotional prose-poem called The Mission of the Idea (1915/1977), in which he attempts to rally Christian youth to share in his commitment to an ideal form of life. Later in Recherche (1918/1977) he presents his ideas more systematically by spelling out the relationship he envisions between science and religion. Faith, he argues, resides in action not in knowledge. It is science that explains the world, provides the laws of nature, and even helps distinguish between good and evil. By keeping these domains separate and rejecting the "egoistic," authoritarian claims of the church, social progress can be achieved as the equilibrated result of science driven by faith.

Piaget rejected two premises in this initial formulation (Vidal, 1987). First, he recognized that far from wanting to guarantee the independence of these fields, his goal should be to base faith on science. Second, his continued research in the natural sciences and his attendance at Reymond's lectures convinced Piaget that Bergson's vitalism was an inadequate model of biological phenomena. This was the period in which Piaget travelled first to Zurich and then to Paris to work with Simon and study at the Sorbonne. Behind all these moves, and his return to Geneva, was his family friend and Christian mentor, Pierre Bovet. Then director of the Institut J.J. Rousseau, Bovet had collaborated with Flourney on the psychology of religious belief. Like others in the liberal Protestant tradition, these psychologists accepted the respective autonomy of religion and science, but believed that faith could be distinguished from other forms of thought. When Piaget returned to work with Claparede, he was able to integrate these studies with his own maturing ideas.

In Brunschvicg's lectures, Piaget (1952a) found the key that would bring these various strands together. Brunschvicg taught that truth in all areas of inquiry depends upon the development of judgment. In contrast to Kant, he rejected the structured mind and the idea of fixed categories and sought to explain how reason emerged creatively in the history of science. Brunschvicg claimed that through time the mind had emancipated itself from the egocentric viewpoint of the individual and achieved self-consciousness in the form of universal reason. God for Brunschvicg, as for Piaget, was defined immanently within this social consciousness.

With several collaborators Piaget set out to verify Brunschvicg's theory empirically by observing how children develop qualitatively superior forms of reasoning. The implication of these studies, which resulted in The Moral Judgment of the Child (1932/1965), was that religious and moral claims cannot be verified scientifically, but it is possible through psychology to determine a hierarchy of values upon which superior judgments can be made. Piaget then concludes from his inquiries with children that the most evolved form of theology is indeed an immanentist conception of God.

It is important to recognize the relationship between logic and psychology that Piaget forms in this argument. From his studies with Parisian children he found that the principle of non-contradiction is the most fundamental criterion guiding the employment of concepts. Since science cannot judge moral and religious issues directly, it must establish which sets of ideas are the most coherent. For

Piaget (1928), systems avoiding contradiction support higher values and thus enable the psychologist in categorizing the hierarchy of judgments to cross from the empirical "is" to the philosophical "ought." "Morality is a logic of action, as logic is a morality of thought. The activity of reason is one and the same" (p. 37).

Just as Brunschvicg was concerned to show how the mind became aware of itself in the history of thought, so Piaget (1932/1965) attempts to determine when the individual ego attains a "grasp of consciousness." This stage had important philosophical and religious implications for Piaget, since the move toward immanence implies that the child must abandon his or her own egocentric viewpoint in favor of shared norms and universal rules. In outline, Piaget argues that the heteronomous morality of obedience develops into an autonomous morality of cooperation as the child comes to reconcile individual desires with the needs of others. In religious belief this transition is paralleled by the movement from an omnipotent, anthropomorphic deity to a spirit implicit within life itself. Vidal (1987) sums up Piaget's thought at the time he published The Moral Judgment of the Child:

> Piaget's oeuvre manifests a view of mental and historical development that is the same in different domains, including moral judgment, conceptions of physical causality, use of language, reasoning, epistemology, and the history of science. Development in all these realms is a movement from egocentrism, concreteness, heteronomy, authority, and transcendence, to objectivity, abstractness, autonomy, contractual reciprocity, and immanence. This movement is progress; from the child and the primitive to the adult and the modern; from undemocratic to democratic regimes; from dogmatic religions to liberal Protestantism. Piaget's developmental research thus resulted in a scientific axiology that reformulated and realized his youthful project of basing morality on science; it granted scientific and philosophical superiority to menaced liberal Protestant values; and it gave an objective foundation and justification to apparently subjective experiences and beliefs. (p. 288)

Like Hegel, Piaget does not share the same epistemological interests that Descartes, Hume, and Kant addressed. In particular, neither Hegel nor Piaget expresses any real concern with questions of skepticism, for both believe that knowledge of the world is an obvious fact of everyday experience. Their common objective is thus to determine which conceptual scheme provides the most adequate view of reality. By treating knowledge as a process rather than a fact, both Hegel and Piaget attempt to identify the forms of thought that best support the rational life. Moreover, in their respective ways each views this conceptual development as a feature both of the history of reason and the personal growth of the subject. However, whereas Hegel sought to answer this question through a phenomenology of consciousness, Piaget proposes a naturalistic concept of mind and a scientific study of intellectual development.

Piaget's Structural Psychology of the Mind

In this section I do not intend to catalog the many interesting facts of intellectual development that Piaget has discovered. I will not list the various substages of thought or discuss Piaget's explanation of the child's construction of physical concepts. Such descriptions fill most books on Piaget and are especially well presented in Flavell (1985) and Ginsberg and Opper (1988). Instead, I shall focus on the central tenets of Piaget's psychological theory. First, I will describe in outline Piaget's view of how the subject constructs meaning through experience. Later in this chapter I will return to examine this process in more detail when I consider Piaget's equilibration theory. (Before this argument can be understood, Piaget's ideas on biological development must be appreciated.) Second, I shall present and assess Piaget's efforts to frame a mathematical model of the mind. Since he employs a number of logical structures to characterize the various stages of intellectual development, I will concentrate on one argument, his explaination of the highest level of reason--abstract thought--through the mathematical group.

Piaget believes that the development of the mind is achieved through the interaction of two separate domains, the individual's subjective drives to construct meaning and the objective structures of the physical world. Like Hegel, Piaget rejects the copy theory of knowledge and the empiricist view that meaning is a simple reflection of reality. Also like Hegel, Piaget does not believe that the mind is prefigured with a priori categories that determine the structure of knowledge prior to experience. Knowlege, for both of these authors, is a progressive construction that reflects the desires, needs, and purposes of the subject.

The structures of meaning that individuals create must match the properties of the world. Accordingly, the child's first attempts to understand reality will focus on the most general features of experience. In time, as infants expand their interests these concepts fail to explain experience in sufficient detail. Actions are frustrated and the child is led to formulate more sophisticated ideas about the world. This process continues, through a series of universally invariant stages, until the achievement of abstract thought where the structure of reality--as it relates to human experience--is captured conceptually in the laws of reason.

In contrast to Kant, Piaget is a realist. He believes that the categories of thought fit the world because they have become adapted to its properties in the course of experience. This is not to say that, for example, our Euclidean and Newtonian conceptions of reality correspond exactly to the structure of the world, but rather to our normal contacts with it. Were human beings to extend their actions, say, to the large scale structure of space or the micro-world of subatomic particles, where different properties of reality come into play, then we would adapt our current concepts to new and more comprehensive categories. For Piaget there is no end to the development of knowledge, and it is not possible to predict what new ideas will be needed in the future exploration of the physical world. Yet Piaget, like Popper (1979), is convinced that scientific advancement approaches truth teleonomically as the structures of knowledge created by the mind gradually adapt to reality.

If the physical world sits on one side of the equation of knowledge, then the biological organism that constructs meaning can be found on the other. Just as reality has a certain structure, so human beings--like all other animals--are born with a genetically prescribed character. We are, after all, a part of the world and, as Lévi-Strauss observed, share in its properties. In particular, because of our evolutionary history of successive adaptations, human children are born with a specific physical make-up. The structure of our perceptual organs, the physiological process of maturation, and the instinctual reflexes of the baby are three characteristics of life that are genetically inherited.

However, in contrast to such physically determined features, Piaget maintains that human beings have no specific cognitive endowment. The mind, he argues, is not structured from birth but develops through the operation of the same general adaptive mechanisms that are shared by all forms of life. For Piaget, every living thing exhibits two fundamental tendencies: the organization of behavior into structural wholes and the progressive adaptation of such systems to higher, more equilibrated levels. As I will show, Piaget (1970) is committed to the view that all structures have an implicit "structuring" component that logically co-ordinates behavior into systematic totalities. To explain this process of adaptation, he employs the complementary concepts of assimilation and accommodation. The first describes the conservative tendency of integrating new experiences into existing structures; the second represents the more radical modification of structures to meet environmental needs. Taken together, as they must be, these dialectical mechanisms enable the organism to mold itself to the properties of the physical world. It is thus Piaget's (1971) claim that this single process of adaptation can explain all aspects of biological and cognitive development.

> Intelligence does inherit something from instinct although it rejects its method of programmed regulation in favor of constructive autoregulation. . . . With the bursting instinct a new cognitive evolution thus begins, and it begins all over again from zero, since the inner apparatus of instinct has gone, and, however hereditary the cerebralized nervous system and the learning and inventive powers of the intelligence may be, the work to be done thereafter is phenotypic. (pp. 336-337)

This continuity between genotypic and phenotypic adaptation supports Piaget's biologically-based epistemology. Knowledge is not an essential form encoded either in the human mind or the structures of the physical world, but a constructive product of human action. The ultimate achievement of this process, mathematical knowledge, cannot therefore be explained in terms of an intellectual intuition (rationalism) or an accumulation of experiences (empiricism), but through a reflection on our activities in the world. Mathematical laws apply to reality because they are based upon co-ordinations achieved by the subject in the course of adaptations to the objective properties of the external world.

Although at birth the baby's behavior is manifestly organized through systems of reflex actions, Piaget (1936/1963) believes that with no awareness of itself or the existence of an independent world the infant is heir only to an egocentric confusion of sensations. The first major achievement of intellectual development occurs through the gradual "decentering" from this original state to the recognition of an autonomous external world of objects whose existence and properties do not depend upon the personal will. Moreover, as one such object in this independent world, the child comes to realize the separateness of the self and thus gains a sense of its own being. Piaget believes that it is only when children learn to anticipate the movement of hidden bodies that they have formed the concept of an autonomous physical world existing beyond their perceptions. Following Poincaré, Piaget recognizes that the holistic quality of such spatial displacements can be captured in the group concept, yet, as I argued earlier, he rejects Poincaré's Kantian claim that this structure is an a priori feature of the mind, and sets out instead to explain its construction during the first two years of experience.

At birth children have no knowledge of the world, their awareness of objects being limited to the separate domains of their sense organs. By coordinating these heterogenous fields within a single structure, the concept of a permanent object is formed. Starting with the inherited reflexes of the infant, Piaget explains how these initial responses to the environment--repeated for pleasure and control--are gradually formed into concepts of action or schemes. Through the assimilation of the child's view of new objects and their accommodation to others, these independent schemes become focused upon common events, finally to be organized into a system that embodies the invariance of an object's properties under spatial transformations. (For a detailed account, see Piaget 1937/1971.)

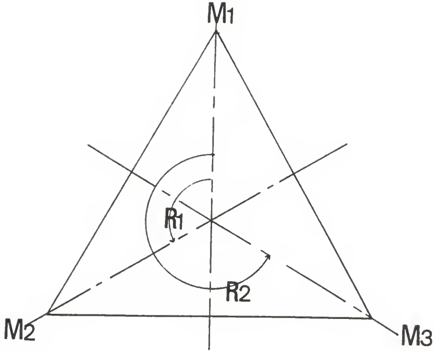
While the group concept enabled Piaget to provide a formal account of the child's spatial understanding, it was to prove even more useful in his subsequent psychological and biological studies. For in this mathematical system, Piaget (1937/1971) found the perfect generalized algebraic description of a relational structure and employed it to explain the entire range of biological and intellectual development.

> The concept of group goes far beyond the construction of space. Every self-enclosed system of operations constitutes a group. In a very general sense one may say that every living or especially psychological organization contains in germ the characteristic operations of the group, since the nature of organization is precisely to constitute a totality of interdependent processes; the concept of group thus forms the principle of this system of operations which logicians have called the "logic of relations," since the product of two relations is still a relation. The logic of relations is immanent in all intellectual activity; every perception and every conception are the making of relationships. If the logic of relations is only tardily reflected as a normative system, it is virtually performed in the functioning of every act of intelligence itself. We may even go so far as to say that every act of assimilation, that is, every relation between the organization of the subject and the external environment, presupposes a system of operations arranged in groups. In effect, assimilation is always reproduction, that is, it involves a reversibility, or a possible return to the point of departure, which precisely defines a group. (p. 236)

Because of the importance of the group concept to Piaget's structural psychology of mind, I will present a simple example of this construct to illustrate the holistic character it embodies. Consider the equilateral triangle and the six transformations I, R_1, R_2, M_1, M_2, M_3 (where R represents a rotation and M a reflection), shown in Figure 5.1. Four properties should be observed: first closure, the combination of any two elements remains within the set of transformations; second, I is the identity operation; third, the composition of these movements is associative (e.g., $R_1 0(M_1 0 R_2) = (R_1 0 M_1) 0 R_2$); and fourth, each element has an inverse, that is, $I^{-1} = I$, $R_1^{-1} = R_2$, $R_2^{-1} = R_1$, $M_1^{-1} = M_1$, $M_2^{-1} = M_2$, and $M_3^{-1} = M_3$. Since these four properties are satisfied, the set $\{I, R_1, R_2, M_1, M_2, M_3\}$ forms a group under the operation of composition as illustrated in the table shown in Figure 5.1.

Notice that under this system of reciprocating movements the shape and properties of the triangle remain constant. This invariance under transformation provides Piaget with a model of all equilibrated structures. So in cognitive development, having first acquired the concept of an external world and a subjective self, the child then must construct an internal representation of physical properties in a group-like system of intellectual structures. It is this mental model of reality, adapted to the observed regularities of experience, that enables human beings to act in and reason about the world.

Piaget explains the child's ability to construct such a mental representation of the objective properties of action through two modes of concept formation: empirical and reflective abstraction. The former is a process of acquiring knowledge about an object's qualities by generalizing perceptions into a figurative image. The latter generates the mental equivalent of a reversible action, that is, a thought that can manipulate an object without altering its properties. Piaget calls such cognitive structures "operations." In sum, intellectual development progresses from perception to reason through the construction of operative schemes that reflectively abstract the objective properties of the world from our figurative knowledge of it.



0	I	R_1	R_2	M_1	M_2	M_3
I	I	R_1	R_2	M_1	M_2	M_3
R_1	R_1	R_2	I	M_3	M_1	M_2
R_2	R_2	I	R_1	M_2	M_3	M_1
M_1	M_1	M_2	M_3	I	R_1	R_2
M_2	M_2	M_3	M_1	R_2	I	R_1
M_3	M_3	M_1	M_2	R_1	R_2	I

Figure 5.1 The Group D_3 of Symmetries of an Equilateral Triangle

Three levels of comprehension are possible. First, the child must construct figurative images through the co-ordination of its perceptions. This, as I have argued, is the task of the sensorimotor period. Second, in the concrete operational phase the child learns to manipulate these images as symbols within thought. Finally, at the level of formal operations abstract reason becomes possible, as the child develops the capacity to think about the properties of objects without invoking figurative images. At this stage, which Piaget equates with scientific rationality, the subject has constructed a group-like conceptual model of the world in which the behavior of objects can be anticipated logically.

Whereas the infant is able only to attain its goals through the manipulation of immediately present objects, the child of the concrete operational period is able to transcend the limitations of the here and now through the construction of mental representations. This is the job of what Piaget terms the "semiotic function," the association of meaning with images or words. Around the age of two years, the child develops the capacity to form mental symbols by identifying absent events and objects with a similar image taken from its previous experiences. Likewise, mental signs are constructed by associating words with such thoughts. But whether this association is arbitrary, as it is in the case of words, or based upon a figurative correspondence, as symbols are, a fundamental point must be observed. Such signifiers do not correspond to referents in the external world, but elements of the child's own personal experience. The subject's knowledge of the world is constructed from within. It is not copied from reality or imposed upon the mind by the structure of language. It is this individualized orientation to learning, concept formation, and language acquisition that undermines Piaget's subject-based theory of development in the eyes of most critics (e.g., Rotman, 1977).

During the concrete period, then, the child's thought is still dominated by perception. Objects cannot be considered in the abstract--from all perspectives--but are limited by the child's idiosyncratic viewpoint. This "centering" of thought must be overcome, as must be the parallel tendency of neglecting certain properties of an object in favor of a dominant perceptual feature. Piaget believes that both problems are resolved through the construction of two conceptual structures. If children are to construct an abstract representation of their experiences, they must learn both how to categorize objects and conceptualize the relationships between their properties. This developing competence is charted through eight stages, four relating to the logic of classes and four to the structure of relations. While these independent "groupings" lack coordination, they each exhibit "weak" versions of the group properties. Of special interest are the reversibility operations. In the case of the class structures, this is the developing ability to "negate" or remove a feature from thought. For example, pre-operational children typically think that the volume of liquid changes when passed between differently proportioned beakers, although they admit that its quantity is retained when it is poured back into the original container. This "empirical reversibility" now can be carried out abstractly, as the subject learns to conduct the inverse operation through mental images. "Reciprocity" is the reversibility operation for relations and consists in the capacity to neutralize a property within thought. This can be seen in the child's realization that the variables within a given situation can be understood only in relation to some controlled factor. Using the same example, the subject will recognize that an equal volume of water is contained by both a tall thin glass and a short fat cup.

Armed with these intellectual structures, the child enters the phase of formal thought. No longer tied to the figurative image, the subject now can organize and control experience conceptually. So whereas the concrete operational child attempts to solve experimental tasks through trial and error reasoning, the adolescent is able to hypothesize outcomes, systematically isolate variables, and test for the properties of objects. In short, abstract thought is characterized by the ability to construct a semantic field (representing the properties of objects), organize and conduct experiments, and determine the causal interrelationships within a situation.

In an effort to formalize these intellectual skills, Piaget (1947) employs two mathematical constructs: the lattice of propositions and the Klein four group. The former lays out all the possibilities within a problematic situation, the latter is used to model the thought strategies of the subject. In Piaget's experiments this typically involves determining the causal or functional relationship between two events. At the formal stage of thought, the two reversibility operations of the concrete period, negation (N) and reciprocity (R), are fused into a holistic structure by a third inverse function, "correlativity" (C).

Piaget says little about the empirical origin of this operation, except to characterize it as the negation of reciprocity, that is, $C=N\ddot{e}R$. Taken together with the identity operation I, these functions define the group shown in Figure 5.4.

Piaget's use of the lattice parallels Wittgenstein's (1922/1966) analysis of the set of propositional functions. The subject, Piaget assumes, has developed an unconscious combinational structure that can generate all the logically distinct statements that can be formed about a given situation. For example, only four different propositions can be constructed about a universe containing a single fact. As the diagrams in Figure 5.2 illustrate, it is possible to form sentences that are always true (tautologies), always false (contradictions), true if fact P is true, and true if fact P is false. In general for a world with n facts 2^{2^n} different propositions can be written.

In Traité de Logic (1949/1972), Piaget considers the 16 possible combinations of the two propositions p and q. The Venn diagrams and lattice of subsets for this "semantic field" are given in Figure 5.3. Later, in Essai sur Les Transformations des Opérations Logiques, Piaget (1952b) extended his analysis to the 256 statements generated from the propositions p, q, and r.

Of course Piaget does not believe such structures are the product of conscious thought or that these strategies of inquiry are employed on all occasions. Like Chomsky, Piaget is attempting to model the unconscious structures of intellectual competence. A person's actual performance may vary greatly depending upon previous experiences. Piaget believes, in fact, that adults tend to learn problem solving strategies that often restrict their appreciation of a situation. Adolescents make the best subjects for Piaget's inquiries because they tend to approach problems with fewer preconceived ideas.

	p	$\overline{p}$	proposition	set
1	T	T	1	12
2	T	F	p	1
3	F	T	$\overline{p}$	2
4	F	F	0	∅

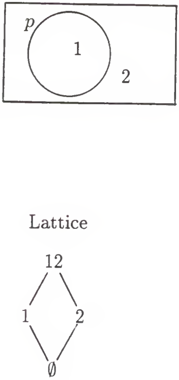
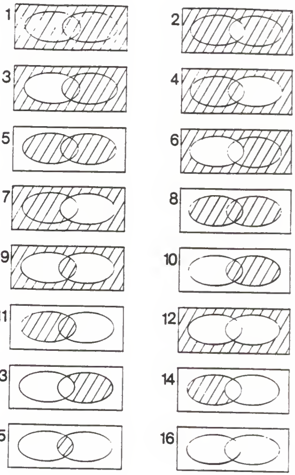


Figure 5.2 The Four Statements on a Single Fact

	$p\cdot q$	$p\cdot\bar{q}$	$\bar{p}\cdot q$	$\bar{p}\cdot\bar{q}$	proposition	sets
1	T	T	T	T	1	1234
2	F	T	T	T	$p \mid q$	234
3	T	F	T	T	$p \rightarrow q$	134
4	T	T	F	T	$q \rightarrow p$	124
5	T	T	T	F	$p \vee q$	123
6	F	F	T	T	$\bar{p}$	34
7	F	T	F	T	$\bar{q}$	24
8	F	T	T	F	$p\mathrm{w}q$	23
9	T	F	F	T	$p \equiv q$	14
10	T	F	T	F	q	13
11	T	T	F	F	p	12
12	F	F	F	T	$\bar{p} \wedge \bar{q}$	4
13	F	F	T	F	$\bar{p} \wedge q$	3
14	F	T	F	F	$p \wedge \bar{q}$	2
15	T	F	F	F	$p \wedge q$	1
16	F	F	F	F	0	0



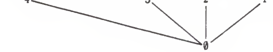


Figure 5.3 The Sixteen Composite Statements of Two Propositions

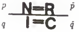
Piaget's experimental tasks are normally designed to investigate the adolescent's problem solving techniques in situations where two properties or events are related. According to Piaget's accounts, these procedures demonstrate how the subject logically attempts to control variables in order to test hypotheses about the causal relationships that underlie the problem. Consider Piaget and Inhelder's (1969) explanation:

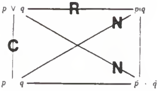
> Let us take as an example the implication $p \to q$, and let us imagine an experimental situation in which a child between 12 and 15 tries to understand the connections between phenomena which are not familiar to him but which he analyzes by means of the new propositional operations rather than by trial and error. Let us suppose then that he observes a moving object that keeps starting and stopping and he notices that the stops seem to be accompanied by the lighting of an electric bulb. The first hypothesis he will make is that the light is the cause (or an indication of the cause) of the stops, or $p \to q$ (light implies stop). There is only one way to confirm the hypothesis, and that is to find out whether the bulb ever lights up without the object stopping, or $p \cdot \bar{q}$ ($p \cdot \bar{q}$ is the inverse or negation of $p \to q$). But he may also wonder whether the light, instead of causing the stop, is caused by it, or $q \to p$ (now the reciprocal and not the inverse of $p \to q$). To confirm $q \to p$ (stop implies light), he looks for the opposite case which would disconfirm it; that is, does the object ever stop without the light going on? (p. 401)

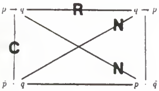
Earlier I discussed the development of two forms of reversibility, reciprocity and negation, which combine with the operation of correlativity to form a holistic mental representation of the physical world. These operations enable the subject to entertain different hypotheses concerning the description of a given event. Thus, in Piaget's example the converse of $p \to q$, that is $q \to p$ is formed through R, while $p \cdot \bar{q}$ is given by N. Further, although Piaget does not state it, operation C applied to $p \to q$ yields $\bar{p} \cdot q$, which also is the negation of $q \to p$. With the identity operation I, these functions thus form a group under composition, as shown in Figure 5.4. In fact, the same mathematical system is produced when $p \vee q$ is chosen as the initial hypothesis to be tested. However, as the diagrams in Figure 5.4 illustrate, the selection of other propositions may yield degenerate structures. Piaget (1955) sums up the entire set of relationships between his INRC functions and the field of propositions in the "magic square" shown in Figure 5.4. (I have amended Piaget's notation to fit my argument.)

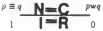
I will present two classes of criticisms against Piaget's model of formal thought. The first addresses his choice of logical constructs; the second their empirical interpretation. As with my

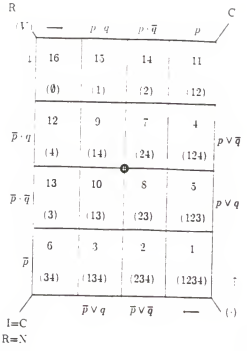
	I	N	R	C
I	I	N	R	C
N	N	I	C	R
R	R	C	I	N
C	C	R	N	I










R
C
I=C
R=N
C=N
I=R

(V)	—	$p\ q$	$p \cdot \bar{q}$	p	
1	16 (∅)	15 (1)	14 (2)	11 (12)	
$\bar{p} \cdot q$	12 (4)	9 (14)	7 (24)	4 (124)	$p \vee \bar{q}$
$\bar{p} \cdot \bar{q}$	13 (3)	10 (13)	8 (23)	5 (123)	$p \vee q$
$\bar{p}$	6 (34)	3 (134)	2 (234)	1 (1234)	
		$\bar{p} \vee q$	$\bar{p} \vee \bar{q}$	—	(·)

[1] The table is constructed either through the join (V) or meet (.) of propositions in the outside rows and columns of the table. Thus 5.3 = 10, 14 v 12 = 7.

[2] Propositions related by R are symmetrical about the leading diagonal, those related by C by the following diagonal while negotitions can be produced by a reflection through 0.

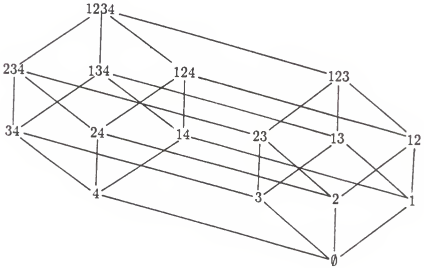


Figure 5.4 The INRC Group and the Lattice of Sixteen Propositions

arguments against Lévi-Strauss and Chomsky, the goal of these objections is to show that the structuralist science of mind is theoretically underdetermined. More precisely, I shall argue that Piaget's structures have no mathematical significance and that his empirical research fails to establish their psychological reality.

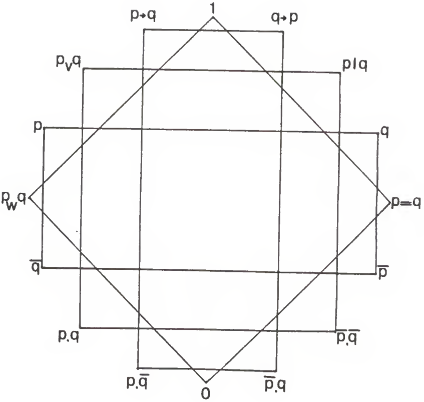
From a logician's point of view, Piaget's choice of the functions R and C generates two major problems. First, they do not partition the set of 16 propositions into symmetric classes, in which all statements have an equal status, but collapse certain groups into limited cycles. Second, as Bart (1971) points out, "the INRC group is incapable of netting the transformation that relates any particular pair of the sixteen binary operation" (p. 542). How, that is, can the statement pwq be translated into the proposition p . q? Of course, Piaget may claim that his "psycho-logic" does not require such transformations since they cannot be observed in formal thought. His aim is to model the way human beings reason, not to set up a complete matrix of logical connections. Yet the point remains that while it is an empirical question to determine which sets of propositions spring from the subject's mind, Piaget's structures offer a very rigid view of thought. Why should the child not be able to reason p . q from p Âq, for surely on being told that "No president can hold office three times," I can conclude that "Reagan cannot run again." Syllogistic logic, it seems, cannot be explained by the INRC group even through it is often employed in thought.

Like Lévi-Strauss and Chomsky, Piaget has constructed a highly technical algebraic description of thought that matches many of the perceived symmetries and complexities of human reason. It is no doubt this systematic capacity to explain the entire range of behavior coherently that seems to raise these structuralist theories beyond criticism. The reader might well wonder how such structures can be questioned when they "fit" all the phenomena we experience. The answer, of course, is that all theories are clearly underdetermined by data and that an infinite number of logically consistent hypotheses can be constructed to explain phenomena. The danger, as these authors demonstrate (especially Lévi-Strauss and Piaget), is to succumb to a particular form of organization for its own intrinsic merits. Yet there is evidence that Piaget, perhaps intoxicated by the elegance of these propositional structures and the group concept, imposed them authoritatively on his description of children's actions (Seltman & Seltman, 1985). Indeed, many of Piaget's arguments clearly demonstrate how his theory leads the data (e.g., Inhelder & Piaget, (1958, pp. 178-180), which I will discuss later in this section).

It is quite easy to formulate alternative logical functions that match the symmetries of Piaget's structures. Consider the new functions R^1 and C^1 which correspond to positive and negative correlations between two properties. R^1 is the rejection of the hypothesis that $p \,.\, \bar{q}$ and $\bar{p} \,.\, q$ are related. That is the denial of the proposition "the car stops if and only if the light goes on." C^1 is defined similarly in terms of $p \,.\, q$ and $\bar{p} \,.\, \bar{q}$. These new functions also form a group under composition, and partition the lattice of 16 propositions into four cycles of four statements, as shown in Figure 5.5. It will be observed that INR^1C^1 group preserves Piaget's main classes while filling out his collapsed systems. Further, in response to Bart's criticisms it can be shown that when any two of the 16 compound statements are combined by R^1 or C^1, the group table illustrated in Figure 5.5 is produced. Notice also that this binary group of order 16 is partitioned into four "cosets" that correspond to the 4 INR^1C^1 cycles and themselves form a Klein four group. Moreover, it can be shown that these same functions produce a similar nesting of mathematical symmetries when applied to the 256 tertiary propositions.

If there are no a priori reasons for choosing Piaget's mathematical constructs over other logical models, it still may be the case that the structures he has identified in fact match the mind's psychological mechanisms; that is, Piaget's use of the INRC group can be justified on empirical grounds from his extensive studies of children's thought. Yet it is at the level of interpretation that Piaget's structuralist model of mind has met the most criticisms. I will consider two objections.

First, as Parsons (1960) argues in his review of Inhelder and Piaget's (1958) The Growth of Logical Thinking, the INRC group is too simple a structure to represent the complexity of abstract thought and often is "stretched" in Piaget's explanations of the child's reasoning strategies. Seltman and Seltman (1985) arrive at a similar conclusion in their analysis of Piaget's (1955) balance beam experiment. Here the propositions p and q are taken to mean "add a fixed weight" and "move a fixed



	1	16	9	8	12	5	2	15	11	6	10	7	13	4	14	3
1	1	16	9	8	12	5	2	15	11	6	10	7	13	4	14	3
16	16	1	8	9	5	12	15	2	6	11	7	10	4	13	3	14
9	9	8	1	16	2	15	12	5	10	7	11	6	14	3	13	4
8	8	9	16	1	15	2	5	12	7	10	6	11	3	14	4	13
12	12	5	2	15	1	16	9	8	13	4	14	3	11	6	10	7
5	5	12	15	2	16	1	8	9	4	13	3	14	6	11	7	10
2	2	15	12	5	9	8	1	16	14	3	13	4	10	7	11	6
15	15	2	5	12	8	9	16	1	3	14	4	13	7	10	6	11
11	11	6	10	7	13	4	14	3	1	16	9	8	12	5	2	15
6	6	11	7	10	4	13	3	14	16	1	8	9	5	12	15	2
10	10	7	11	6	14	3	13	4	9	8	1	16	2	15	5	12
7	7	10	6	11	3	14	4	13	8	9	16	1	15	2	5	12
13	13	4	14	3	11	6	10	7	12	5	2	15	1	16	9	8
4	4	13	3	14	6	11	7	10	5	12	15	2	16	1	8	9
14	14	3	13	4	10	7	11	6	2	15	12	5	9	8	1	16
3	3	14	4	13	7	10	6	11	15	2	5	12	8	9	16	1

Figure 5.5 The INR^{1}C^1 Group

distance." The statements p^1 and q^1 are defined similarly for the same actions on the other arm of the beam. While there are many confusions about notational discrepancies in Piaget's account, what stands out most clearly is the inability of the INRC group to adequately model the child's thought. For instance, Piaget claims that $N (p . q) = \bar{p} \vee \bar{q}$. This statement is logically true (by virtue of De Morgan's Law), but it fails to capture the physical meaning of the action it represents. In fact, the operation $p . q$ could be negated in any one of the following ways; $p^1 . q^1$, $p^1 . q$, $p . q^1$. A subject might even reason "do p twice, or p^1 twice," and so on. But if they followed Piaget's formula and employed the operation $p \vee q$, they might not solve the problem correctly. For $\bar{p} \vee \bar{q}$ means either $\bar{p} . \bar{q}$, $\bar{p} . q$, or $p . \bar{q}$, and only the first of these counteracts the combined effect of $p . q$. As with Lévi-Strauss, Piaget's efforts to capture thought in a system of binary negations seriously underestimates the complexity of the human mind. Moreover, Piaget does little to win support for his arguments by choosing problems with solutions that seem to dovetail the INRC structure. For example, he does not explain how the INRC group can be used to solve a problem like finding the center of gravity of an irregular figure. Yet this is surely a puzzle that an intelligent teenager will be able to solve.

Second, Piaget's greatest mistake is surely his attempt to combine operatory and symbolic logic. How can actions be represented by propositions and be combined coherently with connectives like implication? For instance, should the statement "push forward" be negated as "push backward" or merely as "do nothing?" By describing intellectual and physical operations in terms of truth functional states, Piaget implicitly has introduced symmetries into his explanation of actions that do not exist in actual behavior. The lattice, the INRC group, and Piaget's various other mathematical tools are not so much descriptions of the developing mind as they are the language in which Piaget conducts his investigations. As Seltman and Seltman (1985) sum up,

> consideration of the INRC group with reference to the balance experiment shows it to be inadequate both physically and logically to represent the cognitive situation. The balance itself has built-in constraints which automatically make it susceptible to INRC treatment in a self-fulfilling manner. Again, the assertion that the INRC group structure is responsible for the thinking leading to a solution of the balance problem is unconvincing. For example, certain operations are missing in the subject's remarks. There is confusion between the physical and logical, as well. The 'collapse' from INRC transformation (upon transformation) to logical propositions themselves and then to

> measurable quantity, all based upon a dualistic confusion of rule of combination and element, parallels this. (p.112)

Summary: Psychology and the Mind

Like the structuralist theories of Lévi-Strauss and Chomsky, Piaget's account of cognitive development is an attempt to construct a scientific psychology of the mind. All three authors share the same commitment to the unity of the sciences and suggest strategies for modelling intellectual mechanisms that parallel the methodology employed by physicists. The naturalistic study they propose starts by inferring a set of logical structures as the underlying generators of thought and then verifies the psychological reality of these mental rules by demonstrating how they produce the subjective experiences of an individual. In short, psychology becomes a science when, like other forms of empirical investigation, the phenomena it studies can be subsumed under mathematically constructed laws. As Piaget (1952b) explains,

> without pressing the parallel too far, and without concealing the fact that psychology is some centuries behind physics, we can say that, like physics, it is an experimental science, but one concerned with the study of mental life, whilst its criterion of truth is also agreement with empirical fact. Logic based on the axiomatic method is, on the other hand, a formal science whose sole criterion of truth is deductive rigor.
>
> The need for explanatory schemata in psychology leads us to apply axiomatic logic to psychology itself, and in this way to construct a psycho-logic. Its task would not, however, be to base logic on psychology, but rather to construct by means of the algebra of logic a deductive theory to explain some of the experimental findings of psychology. (p. 465)

While these methodological similarities are important, Piaget's (1955) theory can be differentiated from the thesis of the structured mind on one basic issue. This, of course, is Piaget's commitment to constructivism and his attempt to find a third way between the nativism of Chomsky and Lévi-Strauss and the social holism of Durkheim, through an evolutionary theory of intellectual development. The focus of his theory is neither the structure of the objective world or the subjective ego, but the milieu of their interface.

> The formal structures are neither innate a priori forms of intelligence which are inscribed in advance in the nervous system, nor are they collective representations which exist ready-made outside and above the individual. Instead, they are forms of

> equilibrium which gradually settle on the system of exchanges between individuals and the physical milieu and on the system of exchanges between individuals themselves. (p. 338)

The point to recognize is that for Piaget, the structures of thought cannot be reduced to physical states of the brain. Only through the logic of experience is the subject able to construct mental representations invested with meaning. So while psychology can describe thought scientifically through logical models, it must recognize that the "implicatory" or conceptual relationships these structures forge cannot be discharged physically: The intentional character of human action can only be understood as a fusion of subjective desires and objective properties within a conceptual structure. It is this goal-directedness of behavior that marks the developing mind's purposive control over experience.

Through this double aspect of construction, Piaget attempts the reconciliation of reasons and causes within a naturalistic psychology of mind. Like Hegel, Piaget shows that there is no need to invoke a transcendental subject or erect a distinction between phenomena and noumena to explain the purposiveness of human experience. For meaning is constructed in the agent's interactions within the world, and all intellectual structures must bear the stamp of both the objective properties of reality and the desires of the subject.

While the concept of intentionality presents a serious challenge to nativism, it stands in perfect accord with Piaget's constructivism. The "aboutness" characteristic of mental events arises from the fact that the structures of thought are constructed to satisfy physical, emotional, and intellectual needs. Indeed, to discredit the innatest thesis Piaget (1936/1963) shows in his empirical studies of infant behavior how the actions of the newborn child are governed by instinct and thus occur without purpose. It is not until the co-ordination of the reflex schemes within the most basic structures of meaning that even the simplest forms of means-end activity become possible.

Yet despite Piaget's attempts to avoid the biologism of the structured mind thesis by explaining the genesis of intelligent action through the logic of experience, his account of the development of reason fails to recognize the social nature of thought. Like Lévi-Strauss and Chomsky, Piaget is a methodological individualist. He believes that a science of mind is possible because knowledge is created by each person according to the same general laws of adaptation that operate at every level of life. The individual's subjective attempts to construct meaning are thus explained through the process of equilibration, a model which, as I will argue, generates new structures in response to internally defined conflicts. The central problem with this argument is Piaget's steadfast commitment to the subject as a producer of novel intellectual structures rather than a learner being initiated into the social and historical achievements of a culture. Yet the structures of meaning that he describes in the psychological development of each child cannot be generated from the logical mechanisms with which Piaget characterizes the subjects' intellectual growth precisely because they also depend upon the socially determined reality in which we live. As Hegel shows, it is spirit that defines the world and that through the efforts of extraordinary individuals has emerged gradually to form a comprehensive understanding of experience. The objects, language, and daily events in the child's life thus are created by this labor and are invested with this purpose. The subject does not construct meaning by adapting to physical reality, but by being inducted into the world that spirit creates. As Wartofsky (1983) explains so eloquently,

> actions upon objects are always actions upon objects, true; but objects themselves are not abstract entities, existing in some generalized epistemological or ontological space of action. Objects--especially those that figure in children's activity--are, in large measure, manufactured (i.e., artifacts), especially when they are the objects introduced in laboratory experiments. The world of objects is largely a world of social artifacts that bear the imprint of our intentionality, our needs and purposes, our social and technical skills and structures. What the child learns to see, to touch, to move around, to throw is a range of artifacts that already has a human significance for even the very young child. What is more, these objects of child actions are manipulated in the company of others and by the example of others, in contexts of approval and disapproval, and in the framework of questions, descriptions, and instructions, which all bring the sociality of language into the situation. (p. 13)

According to Piaget, genetic psychology is relevant to genetic epistemology because the child's construction of knowledge repeats many of the tasks undertaken by scientists in the history of ideas. While this should not be regarded as a strict comparison at the level of content, Piaget maintains that each domain is subject to the same laws of organization and adaptation. This continuity of functions from the level of the biological organism to the construction of mathematical structures enables Piaget to offer empirical answers, based upon his psychogenetic studies, to epistemological and normative problems. In the next two sections I shall examine the central thesis of genetic epistemology that the rational development of mind in both psychogenesis and the history of science can be explained through the equilibration process. My argument will be that just as the thesis of the structured mind is tied to biological essentialism, so Piaget's constructivism commits the parallel mistake of basing the universality and necessity of knowledge on the process of equilibration. This mechanism fails to provide Piaget with a science of the mind because it falsely assumes that the problem of knowledge can be solved through an internal self-governing logic of adaptation. In reality, while epistemic progress may be justified as the elimination of error, the development of knowledge is ultimately a creative process that cannot be captured by any mathematical model.

Genetic Epistemology

In the second half of this chapter I will examine Piaget's claim that epistemology is a science of knowledge. The chief hypothesis that Piaget wishes to verify throughout his biological, psychological, and epistemic inquiries is that the mind develops according to an internal logic of organization. To justify this conclusion, Piaget, like Hegel, attempts to discredit theories of knowledge that stress either the subject or the object, in favor of an epistemology based upon their interactive relations. For Piaget the former viewpoint cannot account for the origin of knowledge, whereas the latter fails to explain its structure. In contrast, Piaget proposes "constructionism," a theory that maintains that the universal and necessary structures of thought are produced through the process of adaptation.

For Piaget, the logic that underlies the development of mind must be studied through two separate but related inquiries: first, through an analysis of the structure of knowledge and, second, through an examination of the functional mechanisms that bring about its construction. These twin investigations represent the synchronic and diachronic phases of knowledge in what Piaget argues is the progressive movement of mind toward truth and objectivity. He then integrates the results of these inquiries into a single logic of development, the equilibration model, a system of cybernetic feedback circuits that demonstrate how behavior--the "motor of evolution" (Piaget, 1978)-- causes the subject to construct rationally superior concepts.

After reviewing these arguments I will discuss Piaget's efforts to confirm this hypothesis by revealing parallel forms of organization in psychogenesis and the historical development of concepts. Finally I will present my criticisms of Piaget's thesis. Without attending to the specifics of the equilibration model I will argue that Piaget remains committed to an individualist view of mind that does not square with the socially determined structure and origin of knowledge. I will turn to the social construction of reason suggested by these objections in Chapter 6 when I consider Richard Peters's thoughts on education and the development of mind.

For Piaget (1965), philosophical reflection can yield only wisdom. It is science, which replaces subjective intuition with objective methods of verification, that alone can lead to truth. Yet, despite this fundamental difference, Piaget believes that these disciplines do have an intimate and essential relationship. Philosophy generates scientific insights, whereas science checks philosophical illusion. As history shows, there are numerous cases in which philosophical claims have been refuted by scientific advances (e.g., Descartes's intuition of simple natures and Kant's theory of space). Conversely, relativity physics and quantum mechanics are two current examples of how philosophical considerations can stimulate scientific development. However, with the expansion of knowledge during the 20th century, philosophers no longer can contribute to the scientific enterprise without some degree of technical expertise. The days of the armchair thinker who could envision the entire panorama of human achievements are over, and the problem of knowledge is now tied to the specific concerns of individual sciences.

According to Piaget (1950), epistemology is the second order discipline that examines the nature of scientific knowledge. More specifically, genetic epistemology, as its name suggests, is concerned with the development of scientific knowledge. In particular, Piaget (1950) poses the following fundamental problem: How can "scientific thought. . .proceed from a state of lesser knowledge to a state of knowledge judged to be superior?" (p. 18) As Piaget observes, this itself must be a scientific inquiry, for the determination of what is the most advanced stage of knowledge depends upon the judgment of the subject specialist. Genetic epistemology is thus an empirical examination of the various stages of thought that have emerged within specific domains and science in order to discern if there are any general laws in the development of knowledge. Piaget's conclusion, which I will reject, is that the same logic of organization and adaptation found in the biological evolution of species and the intellectual growth of children also operates in the abstract realm of concepts. This claim, it should be noted--as a scientific hypothesis about knowledge--is itself subject to these same laws. So the validity of Piaget's arguments depend, like Hegel's Phenomenology of Spirit, on a genetic examination of the history of epistemology.

Piaget (1950) suggests that genetic epistemology can be viewed as a kind of "mental biology." On one hand it proposes an "anatomy" of the different stages of knowledge; on the other, it offers a "physiological" theory of their relationship. This comparison--based upon his science of genera--of biological structures and functions with epistemological structures and functions leads Piaget to equate the development of knowledge with the development of species. The result is an evolutionary theory of science that, as Kitchener (1986) observes, parallels in several important respects, that presented by Popper (1979).

Genetic epistemology, then, has two phases, one corresponding to the structure of knowledge and the other to its process of development. First, scientists within their respective disciplines must develop a hierarchial taxonomy of the different stages of knowledge, according to the kinds of judgments each level generates. Since this investigation is limited by the accessibility of information, especially at the scientifically interesting period of prehistoric development, Piaget proposes to complete such inquiries through his psychological studies of children's judgment. To continue the analogy, knowledge can be investigated through psychogenesis as a form of "mental embryology."

> It is thus for want of something better, because the scientific notions are initially tied to those of common sense and because the prehistory of these notions risk forever being unknown, that it is necessary to complete the historico-critical method by the psychogenetic methods. (Cited in Kitchener, 1981, p. 106)

In Structuralism, Piaget (1970) criticizes those epistemologists who regard knowledge as a fact, and, ignoring the development of concepts, seek to legitimize a particular view of the world. For such thinkers Piaget's analysis of structures, while being of historical interest, would have little or no theoretical import in the justification of scientific knowledge. But these philosophers, Piaget argues, miss the essential nature of science, which, as history demonstrates, consists in the continual adaptation of theories to the properties of the world. Knowledge, Piaget (1970) believes, must be regarded as a process, and epistemology must be viewed as a study of concepts in their historical movement toward truth.

> Scientific knowledge is in perpetual evolution; it finds itself changed from one day to the next. As a result, we cannot say that on the one hand there is the history of knowledge, and on the other its current state today, as if the current state of knowledge is a moment in history, changing just as rapidly as the state of knowledge in the past has ever changed, and in many instances, more rapidly. Scientific thought, then, is not momentary; it is not static instance; it is a process. More specifically, it is a process of continual construction and reorganization. (pp. 2-4)

Genetic epistemology turns to the nature of this constructivist process in its second phase of inquiry. From the outset, the limits of this investigation must be recognized. For epistemology does not study the process of development in order to predict the future, as if science were somehow prefigured; Piaget always maintained that thought has a creative element and the construction of mind is full of possibilities. Rather, genetic epistemology aims to describe retroactively the development of knowledge up to its current stage, as the rational construction of increasingly objective structures. However, like Hegel's dialectic, the necessity of this process can be seen only in hindsight.

It is interesting to observe how Piaget's philosophy of science differs from the theories typically presented by Anglo-Saxon thinkers. As Kuhn (1965) explains it, most historians offer an internal account of development, citing the role of crucial experiments, significant debates, or influential papers in the choice of theories. Kuhn rejects this "homogenized" version of science and focuses on the non-rational, external forces that shape the course of inquiry. He thus chronicles the dictates of the church, political climate, social concerns, and the economic pressures of the time as the dynamics generating scientific change. From this perspective, the history of science is seen not as linear development of knowledge, but as a series of "revolutions" that lead thought non-logically through time.

Like Popper (1979), who opposes the view that there is no logic to the development of knowledge, Piaget (1986) believes, unlike Kuhn, that science does lead rationally toward the objective properties of the world. Piaget offers a very different picture of development, for his account of scientific progress does not contain events, people, or famous experiments. Rather, in a manner similar to Hegel's Phenomenology, Piaget presents a conceptual history of ideas. His account of scientific development thus concerns the evolution of certain fundamental concepts, which like the Kantian categories seem implicit in all efforts to describe the world. Yet unlike their Kantian counterparts, Piaget's concepts only acquire their a priori status through the process of construction as they prove themselves suited to the task of explaining reality. According to Piaget, the development of ideas, such as space, time, causality, force, number, and chance, must be viewed as moments in the gradual adaptation of knowledge to the world. It is by examining the progressive manifestation of these concepts that the "truest" representation of experience is found. Moreover, in contrast to Popper (who adopts an external Darwinian "survival of the fittest" theory of the history of science) Piaget--again like Hegel--believes that the growth of knowledge has an implicit direction and that through the dialectic of concepts ideas can approach the properties of reality, even though, as with Popper's (1979) convergent realism, this limit is never actually attained. The ultimate achievement of this development is the constructed necessity of mathematics. As Boden (1979) explains, "for Piaget (1970). . .biological principles. . .not only guarantee 'the harmony of mathematics with the real world' (p. 339) but also show the rise of logico-mathematical knowledge to be a necessary crowning of the whole evolutionary process" (p. 105).

Piaget's historical analysis of concepts, like his study of intellectual development, cites no characters and does not concern the performance of individual subjects. Like Chomsky, Piaget attempts to establish a competence model of mind, capturing the development of thought through a sequence of logical stages. Since this evolving corpus of structures, the "epistemic subject," emerges both in the psychogenesis of mind and historico-critical analysis of concepts, each inquiry becomes a parallel investigation into the universal laws of thought. So while Piaget's epistemic subject may be compared with the psychological subject, it actually has a much wider application. As the abstract embodiment of the laws of thought, it can be interpreted as the mind writ large, developing from the earliest forms of biological organization to the level of pure reflection achieved in mathematical knowledge. Like Hegel's spirit, Piaget's epistemic subject is reality coming to know itself.

The Genesis and Structure of Knowledge

Every epistemology must define a theory of mind and explain how the subject acquires knowledge of the object. Since genetic epistemology is the science of the development of scientific knowledge, Piaget believes that it should be able to establish itself as the most advanced statement of this relationship. So, like Hegel, he thus proposes to consider all theories of knowledge for the most consistent account of experience. Just as Hegel criticized the attempt to know prior to the act of knowledge, so Piaget (1950) argues that only a genetic approach to epistemology can reveal the nature of mind, even if, as Kant thought, experience is found to be structured by a fixed set of categories. Further, just as the Phenomenology followed those forms of thought that stress the role of the object, and then the subject, before finally considering their unity, so Piaget proposes a parallel classification of the six genetic and non-genetic epistemologies, shown in Table 5.1.

Along with each epistemology, Piaget (1971) loosely associates a compatible psychology and biology, as illustrated in Table 5.1. It is not that these positions are welded to one another, but rather that when presented in their pristine form they take the same orientation toward development and experience. Even so, it is quite natural for gestalt psychology to be associated with Kantian apriorism, as Piaget (1936/1963) had recognized in the Origins of Intelligence, just as it is possible to hold competing epistemologies simultaneously, as Poincare did in maintaining that scientific knowledge is a matter of convention, whereas mathematics depends upon synthetic a priori judgments.

Although history has witnessed many formulations of these epistemological positions, two theories have become particularly entrenched in Western thought: empiricism which adopts the

Table 5.1 Piaget's Classification of Epistemologies

EPISTEMOLOGY

(Psychology) [Biology]	Non-Genetic Theories	Genetic
Primacy of the object	Realism-Plato [Creationism]	Empiricism-Hume (Behaviorism) [Lamarckianism]
Primacy of the subject	Apriorism-Kant (Preformationism)	Conventionalism-Poincare (Grouping)
Interactive relationship	Phenomenology-Husserl (Gestaltism)	Relativism-Brunschvicg (Genetic psychology) [Epigenetic Assimilation]

(Adapted from Chapman, 1988)

scientific paradigm and stresses the role of the external world as the source of our concepts; and rationalism, which emphasizes the organizational capacities of the mind and models knowledge on mathematics. While the former accounts for the origin of ideas (in the object), Piaget believes that it cannot explain the universality and necessity of knowledge. Conversely, the latter, in emphasizing the contribution of the subject, justifies the form of knowledge at the expense of its content. Piaget (1970) thus labels empiricism as "genesis without structure" and rationalism as "structure without genesis." By revealing the limitations of these two attitudes, Piaget aims to show that only a genetic epistemology can do justice to both the subject and the object within experience and thus proposes his own theory, relationism, as the dialectical aufheben "structure with genesis."

Genesis Without Structure

In his criticisms of genesis without structure, Piaget packages empiricism, associationism, and Lamarckianism together. Clearly, empirically-minded philosophers like Quine (1968) do not consider themselves Lamarckian, but believe that human beings inherit a stock of innate capacities in accordance with the Darwinian thesis. Like Chomsky, Piaget has a tendency to polarize opposing positions, reject them, and adopt an "only theory left standing" argument.

Piaget's (1971) criticisms of empiricism run as follows: Empiricism is correct in identifying the role of experience, but it cannot explain the universal and necessary character of thought. If knowledge does arise from a structured external world through a causal model of perception, then all ideas must be contingent upon the personal history of each learner. Ultimately, every individual would acquire a different, and finite, understanding of reality that could not explain the application of thought to new experiences. Nor can this model account for the regular development of concepts that Piaget has chronicled in the intellectual growth of children. Anticipating Chomsky's attack on behaviorism, Piaget also argues that associationism is unable to explain the qualitative advancement in children's thought, since the structured complexity of thought and action far outstrips the aggregate of particular experiences.

However, while rejecting empiricism, Piaget is careful not to throw the baby out with the bath water. He recognizes that all knowledge of the world ultimately must depend upon experience, but he maintains that concepts are not presented freely by the environment any more than they can be considered a gift of birth. For Piaget, the Lamarckian thesis must contain a germ of truth. The facts of evolution, he believes, demonstrate that changes in the phenotype--effected by experience--can elicit genotypic variations. All forms of adaptation, whether biological, cognitive, or epistemic involve a degree of learning through the fitting of structures to experience. As such, the common problem shared by both the Lamarckian thesis and the empiricist model of the mind is thus a failure to recognize this accommodative "structuring" capacity of the subject.

Structure Without Genesis

Piaget agrees with the second orientation, structure without genesis, that the subject organizes experience. As I argued in Chapters 3 and 4, a recent expression of this viewpoint is the Kantian thesis of the structured mind, presented in the naturalistic theories of Chomsky and Lévi-Strauss. Both believe that human beings are born with an innate intellectual endowment, cognitive mechanisms that define the nature and limits of thought, and both propose to identify these unconscious universal structures through new forms of psychology. Piaget is also committed to a structuralist science of the mind and employs similar methods and models in his efforts to describe the psychological mechanisms of thought. Yet he rejects the central assumption that both Lévi-Strauss and Chomsky share by insisting that the mind is not prefigured at birth but develops through the logic of experience. Accordingly, in his criticisms of these authors, Piaget attempts to refute their belief in the fixity of thought by demonstrating how intellectual structures are a product of activity originating in the sensorimotor behavior of the child. It is not that Piaget (1970) wishes to discredit either Lévi-Strauss's analysis of culture or Chomsky's theory of grammar; on the contrary, his aim is to assimilate their ideas into his own account of the constructive mind. In light of this goal it will be instructive to review briefly Piaget's criticisms of Lévi-

Strauss before comparing his ideas on the relationship between language and thought with those presented by Chomsky.

In The Elementary Structures of Kinship, Lévi-Strauss (1949/1969) examines the then current research on the nature of mental structures. Influenced by Susan Issac's debate with Piaget, in which she stressed the continuity between the thought of the child and that of the adult, Lévi-Strauss dismissed Piaget's notion of developing structures (Gardner, 1981). In particular, he argued that like Levy-Bruhl, Piaget's comparison of the child's intellect with the mind of a primitive was based upon a confusion of form with content. According to Lévi-Strauss, the different stages in the development of the child's thought identified by Piaget were best explained through a process of familiarization with the social order and did not present any evidence of qualitative increases in the power of the mind. As Lévi-Strauss's (1949/1969) use of the model of langue shows, he views the brain mechanisms underlying social organization as structural "wholes" governed by a "regulating principle that can be given before the parts" (p. 100). Turning to Gestalt psychology as a representation of these inferred mental structures, he argues that since gestalts are the product of neurological networks, thought, itself an epiphenomenon of the brain, must be subject to the same laws of organization. Although Lévi-Strauss (1971) amended this position somewhat in The Naked Man to accommodate Piaget's (1970) criticisms, he nonetheless retains the view that while structures may vary through time and between societies, they still are generated by the same fixed matrix of innate mental oppositions and symmetries.

Against Lévi-Strauss's belief in fixed categories of thought, Piaget stacks both his detailed analysis of psychogenesis and his historico-critical studies of concept development. For Piaget, both inquiries demonstrate that thought passes through a series of equilibrated stages in which cognitive and epistemic structures progressively adapt to the properties of the world. His research thus endorses the central claim of gestalt psychology that knowledge cannot exist without a structure to assimilate content, but undermines the belief that such mental representations are fixed from birth. Gestalt structures thus are "too pure" for Piaget in the same sense that Kant's categories are too pure for Hegel. Piaget also saw the concept of a gestalt as a poor model of a holistic system because it fails to explain how the whole may be influenced by the parts. This accommodative process, which Piaget believes is shared by all forms of organization, leads the organism, the child, and the epistemic subject toward more equilibrated stages. In short, Piaget is convinced that without a concept of structure that "learns" from experience, it is impossible to explain the subject's adaptation to the world, since knowledge of unexperienced properties cannot be present at birth. In particular, Piaget refuses to accept that necessity implicit in mathematics could be the product of biological mutations and gives repeated examples from child psychology that illustrate the subject's emerging modal understanding depend upon its own activities.

In rejecting Lévi-Strauss's thesis of a structured mind, Piaget's theory also stands in opposition to Chomsky's arguments for a universal grammar. This confrontation between two of the world's most prominent intellectuals has generated many fascinating debates, including their celebrated meeting at the Abbaye de Rouymount. Some commentators (e.g., Botha, 1989) have focused on the differences between their respective viewpoints, and, like Chomsky himself, attempt to distance one from the other. Such arguments typically focus on issues concerning the origin of mental structures. Are linguistic and cognitive representations hardwired in modular units within the brain or are they constructed through some general intelligence mechanism? Conversely, other critics (e.g., Sinclair, 1987) have followed Piaget's life-long tactic of assimilating other theories into his own system. Such commentators stress how the common aims and methods of these authors outweigh their differences. Both men, they observe, wish to establish a structuralist science of mind based upon competence models of unconscious mental rules. Further, both Chomsky and Piaget reject empiricist accounts of learning and emphasize the generative role of the subject in the organization of experience.

Rather than adding my voice to the extensive literature on this tangle of claims (e.g., Gardner, 1980), I will confine my comments to what I consider to be a common failure of both approaches, namely, the attempt to explain human behavior without reference to the social context of language and thought. Both Chomsky and Piaget offer a science of the subject that presents a drastically impoverished view of the cultural and historical conditions that make life possible. This commitment to the individual can be seen in the postulated relationship between language and thought that these authors subscribe to. For Chomsky, language is an autonomous faculty that grows independently of thought. In his view, linguistic competence does not depend upon intellectual development but exists as a biological property encoded in the subject's genome. Piaget also accepts the existence of a system of mental rules but attempts to avoid Chomsky's nativism by demonstrating that such structures are the product of the child's sensorimotor activity; that is, although Piaget (1923/1955) initially argued that language shapes thought, his later empirical studies led him to conclude that children construct their own intellectual schemes. So while a child may use certain words correctly, Piaget showed that such verbal skills cannot be taken to imply the capacity for adult thought. As Piaget's famous conservation experiments illustrate, language may well disguise the immature reasoning abilities of children. Just learning words, like learning facts, does not teach us how to think. In short, for Piaget as for Chomsky the appropriate logical structures must exist before speech can be employed. The point to recognize, then, is that irrespective of the origin of this "fixed nucleus," both authors believe that these inner mechanisms either are constructed or pre-figured prior to the subject's initiation into the social forms of communication.

The relationship that Piaget and Chomsky propose between language and thought is opposed by the view of mind but forward by the Russian psychologist Lev Vygotsky (1934/1962). Stressing the social and linguistic determinants of thought, Vygotsky rejects the scientific aspirations of psychology and argues that the study of mind should be included within the humanities. Like Piaget, Vygotsky identifies different genetic roots for language and thought, tracing their development to the pre-intellectual speech and pre-linguistic thought of the child. A crucial moment occurs after two years when these lines converge facilitating verbal thought and rational speech. Subsequently, Vygotsky argues, a period of five years passes in which the internal processes of thought are brought under the control of language. This is a time in which children often are found talking to themselves in order to direct and evaluate their actions, a phenomenon that Piaget calls "egocentric speech." According to Vygotsky, after the age of seven children talk only when they wish to communicate, which is a sign that thought has adapted to the structure of language. In contrast, while Piaget admits that language is indispensable for abstract reasoning, he nonetheless retains his conviction that children cannot command verbal expressions until they have acquired a system of mental structures derived from their actions in the world (Atkinson, 1983).

Whereas Piaget's experiments seem to establish the existence of a time lag between the acquisition of syntactical ability and semantic comprehension, the radical separation between thought and language he postulates remains problematic. Even the development of the semiotic function (the ability to think symbolically through actions and figurative images as well as through language) does not support his thesis of a lone individual constructing thought according to the equilibrium process. As Hamlyn (1978) points out, the young child is immersed in the social context of meaning from birth.

> The . . . gestures, actions and expressions [of parents] . . . direct their [pre-linguistic children's] movements and correct what they do. Above all perhaps, in the earliest days, they express and thereby communicate feelings by their responses to the child. It is in the context of this sort of thing that we must see the understanding of language eventually emerging. (p. 104)

Vygotsky's views are thus popular with those culturally-minded philosophers (e.g., Harré, 1980; Manacas, 1980; Margolis, 1984) who, following in the tradition of the later Wittgenstein, see an intractable social component in linguistic and intellectual development. In contrast to the methodological individualism of Lévi-Strauss, Chomsky, and Piaget, the socially interactive psychology of mind they put forth offers a model that explains both the intentional characteristics of thought and the consensual nature of human rationality. This is a point I emphasized earlier and to which I will return in my criticisms of Piaget's constructivist thesis.

To recap Piaget's criticisms of "structure without genesis": The thesis of the structured mind rests upon the assumption that the form of thought can be specified in advance of experience. Against this, Piaget offers detailed descriptions of intellectual development that he claims demonstrate the evolving logic of thought and the adaptation of the mind to the properties of the world. He argues that knowledge of reality--intellectualized in the operations of formal thought--cannot be specified prior to the child's experiences within the world. Indeed, he maintains that cognitive development must be seen as a decentering process, from the initial egocentric perspective of the infant to a system of thought that is independent of a particular viewpoint. On this account, intellectual development is not some inner unfolding, but a gradual replacement of subjective schemes--which rely upon the distorting effects of perception--with mental rules constructed out of the individual's activity in the world. In sum, since Piaget holds that rational thought depends upon the properties of the object, it cannot be defined in advance of experience.

For Piaget all attempts to explain the universal categories of thought through the structured mind thesis are species of "biologism" and ultimately must rest their argument on the Darwinian thesis. Yet Darwinism, Piaget believes, commits the opposite mistake of Lamarckian theory. It stresses the internal organization of the subject and neglects the influence of the object. By emphasizing the fixity of the organism's structure, Darwinism substitutes a belief in evolution through "blind mutations" for the Lamarckian notion of adaptation by learning. But for Piaget, as for Hegel, the idea that development is in some sense fortuitous is an anathema. The perfect level of adaptation evidenced by organs like the human eye demonstrates that biological structures seek to fit their environment, just as knowledge approaches truth within experience. It is to this logic immanent in life that Piaget turns in his tertium quid, genesis with structure.

Genesis With Structure

Piaget wishes to preserve the truths of apriorism and empiricism without falling into the one-sided view of experience that each promotes. With the former he agrees that there can be no knowledge without structure, whereas with the latter he accepts that all knowledge depends upon experience. Piaget's project thus bears a striking similarity to Kant's reconciliation of rationalism and empiricism. However, despite this common project it is important to recognize a number of fundamental differences between their epistemologies. Like Hegel, Piaget does not believe that structures exists prior to experience, waiting as it were to be filled up or to be employed in the direction of our senses. In fact, apart from the baby's most basic instinctual reflexes, Piaget maintains that human beings are born without any intellectual structures. Moreover, while he agrees with Kant that knowledge is a construction, Piaget repeats Hegel's criticisms of the passive role that Kant ascribed to the object in merely conforming to the categories.

In Piaget's theory, all knowledge arises through the formation of structures in the interactive milieu of relationships that exist between the individual and the environment. So, again like Hegel, and in contrast to Kant, Piaget argues that the categories must be constructed within experience and cannot be accepted as the lucky outcome of evolution. This epigenetic system, initially undifferentiated in the egocentric experiences of the infant, is eventually intellectualized into a conscious subject set against an external world. This mini-Copernican revolution is re-enacted by all children through the construction of the permanent object schema and the group of spatial displacements. So while Piaget--like Kant--believes that all our experiences of the world are grounded in the concept of space, he attempts to show that this necessity is not an a priori fact of consciousness, but is a developmental product of psychogenesis.

As I described it earlier, Piaget's theory of the constructive mind combines two phases of inquiry: first, an identification of the a priori structures of knowledge, and second, an explanation of their necessary development. In the following section I will examine Piaget's concern with the organization of concepts. In particular I shall emphasize two important features of Piaget's argument, namely, that knowledge must be equated both with structure and a cognizing agent. Like Kant, Piaget attempts to reduce scientific ideas to the mental operations of a universal mind or epistemic subject. My intention is to reject this link between cognition and knowledge in favor of a social view of thought governed by language, culture, and ideology. To this end I shall introduce the work of Michael Foucault (1966), who, writing in the same intellectual current as Piaget, presents a radically different interpretation of history and mind. Indeed, it seems to me that Foucault's analysis of knowledge and the subject offers the most serious challenge to Piaget's project, undermining both his efforts to base structures on the cognitive mechanisms of an ideal idiolect and his attempt to write an internal logic of thought. Foucault (1966) is suspicious both of claims about human nature--like those put forth by

Chomsky and Lévi-Strauss--and historicist theories of reason. In their place he offers a painstaking archeology of knowledge to demonstrate that the genesis of ideas is not a question of the logic of concepts, but the political and cultural conditions of life. Piaget's theory of equilibration will be judged against this powerful critique in the final sections of this chapter.

Structure

The Epistemic Subject

Piaget's "mental anatomy of thought" rests upon the conviction that holistic structures of organization can be found at all levels of development. Throughout the continuum, from biological to cognitive and then to epistemic structures, these systematic orders share two fundamental characteristics. First they define a set of reciprocating relationships between parts and whole that establish actively compensating organizations. The elements of such systems are not statically defined by the whole but actually seek to combine and control it. Structures then are "structuring" totalities. This implicit organizing tendency enables Piaget to explain the purposive construction of stages as adaptations generated by a series of disequilibriums.

Second, Piaget--like the advocates of the structured mind thesis--is committed to the view that all systems of thought must be explained through the cognitive mechanisms of the brain. Structures are not the products of a Durkheimian social a priori, but are the co-ordinations of a "structuring" agent. So while Piaget (1970) expresses his lack of interest in the personal self, he nonetheless is committed to the position that all knowledge is generated by psychological schemes of the unconscious mind. Genetic epistemology thus is a form of methodological individualism, a study of the developing mind through the construction of an abstract idealized epistemic subject.

> Thus, in the first place, structuralism calls for a differentiation between the individual subject, who does not enter at all, and the epistemic subject, the cognitive nucleus which is common to all subjects at the same level. In the second place, the always fragmentary and frequently distorting grasp of consciousness must be set apart from the achievements of the subject; what he knows is the outcome of his intellectual activity, not its mechanisms. Now after such precipitation of the "me," the "lived," from the "I," there remains the subject's "operations," that which he "draws out" from the general coordinations of his acts by reflective abstraction. And it is these operations

> which constitute the elements of the structures he employs in his ongoing intellectual activity. (p. 139)

The rise of the structuralist movement during the 1960s provided Piaget (1970) with the opportunity to present his epistemology to a wider and more sympathetic audience. His strategy, as might be expected, was to assimilate other structuralist theories--based upon the concept of langue--into his own dynamic and evolving view of mind. Yet despite his overtures, most theorists remained skeptical if not hostile to Piaget's efforts to induct their work into the mathematical and empistemological framework of genetic epistemology. As I argued earlier, both Lévi-Strauss (1971) and Chomsky (1980b) maintained their belief in the structured mind, whereas Foucault's (1966) work stands squarely against Piaget's views of structure, subject, and development.

According to Piaget (1970), the "faddism" of the structuralist movement that swept France during the 1960s stole the limelight from its long and distinguished history as a scientific methodology. Behind the facade of "trendy" theories Piaget identifies "analytic structuralism," an orientation to inquiry that, he claims, can be found on the cutting edge of all areas of knowledge. Against traditional attempts to fragment experience into controlled and predictable units, Piaget believes that analytic structuralism offers a new standard of progress and intellectual honesty. Its objective is to reduce phenomena to underlying rules that will provide self-sufficient and intelligible explanations of experience in order to reveal the inner meaning of the world.

In his short book Structuralism, Piaget (1970) introduces the reader to the fruitfulness of this paradigm in a panorama of disciplines. He discusses the role of structuralism in mathematics, linguistics, physics, sociology, psychology, anthropology, and philosophy, and from these disparate inquiries identifies a common theoretical commitment to a holistic conception of meaning. Piaget's claim is that this systematic organization is best captured, not in the model of langue, but by the mathematical group. This construct incorporates three properties that Piaget believes are central to structures of meaning in all domains. First is wholeness, which since Recherche Piaget had modeled upon the dynamic organization among parts in a living system. Second, structures must incorporate laws of transformation through which elements may interact without destroying the identity of the whole.

Third, the integrity of the structure should be preserved through the property of self-regulation. The group provides a prototype model of just such an equilibrated, self-regulating system of invariant transformations.

While Piaget's concept of structure seems suited to his description of biological, cognitive, and epistemic stages, it does not apply as clearly to the systems developed by Chomsky and Lévi-Strauss. For although Chomsky discusses transformations, these are defined between (rather than within) structures and are not associated with any notion of self-regulating equilibrium. In the case of Lévi-Strauss, as we have seen, myths and kinship structures can be described by mathematical groups. The concept of equilibrium under transformation also applies, but the interactive relationship between part and whole expressed through Piaget's notion of self-regulation finds no correlate. For Lévi-Strauss structures are based upon gestalts, where elements are strictly defined by the whole. Here, as Piaget (1970) recognizes, a static equilibrium is maintained while parts change through simple permutation. Women move from clan to clan and symbols are switched in and between myths, but structures remain fixed.

The chief difference between Piaget's "authentic" structuralism and these "static" counterparts lies with the question of genesis. According to Piaget (1970), "there is no structure apart from construction, either abstract or genetic." (p. 140) So he believes that researchers in all areas face the intellectual imperative of explaining not only the logic of knowledge, but also its origin.

> Even in varieties of structuralism which are not formalized in the strict sense, one finds outstanding workers who are so little concerned about psychological origins that they jump straight from the stability of transformation rules to their innateness. Noam Chomsky is a case in point: for him generative grammars appear to demand innate syntactic laws, as if stability could not be explained in terms of equilibrium mechanisms, and as if the appeal to biology implied by the hypothesis of innateness did not pose problems of formation just as complex as those involved in a psychological account. (p. 12)

Yet the question of genesis is not simply a psychological issue for Piaget; it is also a logical problem implicit in the concept of structure. For unlike other structuralists who adopt the model of langue and a diachronic view of system, Piaget bases his concept of the whole on the biological model of the organism and the evolutionary commitment that the central tendency of life is always to "overtake itself" by seeking more integrated and open forms. In a sympathetic review of Structural Anthropology for instance, Piaget (1970) applauds Lévi-Strauss's attempts to identify cognitive universals but rejects his Kantian commitment to a structured intellect in favor of constructivism and the effort to explain both the genesis and structure of meaning as a rational and necessary process.

> None of the preceding observations throw doubt upon the positive, that is, specifically structuralist, aspects of Lévi-Strauss's analyses. Their sole purport is to induce this structuralism to leave its splendid isolation. Because it installs itself from the start in finished products, the traits which are perhaps most characteristic of human activity, even in its cognitive aspect, tend to be overlooked. Whereas other animals cannot alter themselves except by changing their species, man can transform himself by transforming the world and can structure himself by constructing structures; and these structures are his own, for they are not eternally predestined either from within or from without. So, the history of intelligence is not simply an "inventory of element"; it is a bundle of transformations. . . . Granting that reason does not evolve without reason, that it develops by virtue of internal necessities which impose themselves in the course of its interactions with the external environment, nevertheless, reason has evolved, from the level of the animal or the infant to the structural anthropology of Lévi-Strauss himself. (pp. 118-119)

If Piaget's concept of structure does not match that employed by Lévi-Strauss, it comes into radical conflict with Foucault's notion of an episteme. Indeed, Piaget (1970) characterizes Foucault's archeology of the human sciences as "a structuralism without structures." Piaget's (1970) main argument is that Foucault presents a capricious view of history, where "reason's self-transformations have no reason. . .and its structures appear and disappear by fortuitous mutations and as a result of momentary upsurges" (p. 134). Unlike Piaget's biological model of structure, the episteme does not define a system of self-regulating transformations. Rather, modelled on langue, it is intended to show how external forces and codes, institutionalized in language and other social agencies, impose their form on thought. Foucault thus writes in opposition to all "subjectivist" views of rational development to demonstrate that the categories of thought are socially constructed and that reason--far from "pressing" toward truth--"mutates" capriciously through history. This is an enterprise which, as Piaget (1970) recognizes, threatens the two central concerns of genetic epistemology, the genesis and structure of knowledge.

> To call Foucault's structuralism a structuralism without structures is, accordingly, no exaggeration. All the negative aspects of static structuralism are retained--the devaluation of history and genesis, the contempt for functional considerations; and, since man is about to disappear, Foucault's ouster of the subject is more radical than any hitherto. Indeed, his structures are in the end mere diagrams, not transformational

> systems. In this irrationalism only one thing is fixed, language itself, conceived as dominating man because beyond individuals. (pp. 134-135)

According to Foucault (1966), the belief that the individual creates meaning in the world is the principal myth of the Western intellectual tradition. Even the Freudian unconscious (and by implication Lévi-Strauss's "structured mind," Chomsky's ideal speaker, and Piaget's epistemic subject) are rejected in Foucault's apocalyptic death of the subject. On his account, it is not the subject that creates language, but rather language creates the subject. What makes Foucault's arguments so convincing are his meticulous efforts to reconstruct the underlying "grammar" of an era by assembling evidence taken from original documents of the time. The immense power and erudition of this critique brings different periods of history into focus and convinces the reader of the historically changing norms of thought. In what follows I will briefly discuss Foucault's (1966) history of the social sciences. This review will serve two purposes. First, it will underscore the limitations of Piaget's commitment to the individual. And second, it will illustrate the implausibility of Piaget's efforts to describe the growth of science through the intellectual development of the epistemic subject.

Michel Foucault

If one of Lévi-Strauss's achievements has been to show the rational basis that underlies even the most exotic of primitive practices and customs, then Michel Foucault has performed a similar task for the history of ideas. On some of the apparently eccentric beliefs developed in the past from a contemporary standpoint, looking back might lead one to believe that only recently has rational, scientific understanding triumphed over a state of irrationality and confusion. Indeed the standard Whig view of the growth of knowledge often presented in textbooks chronicles the emergence of contemporary ideas as if humanity had gradually drawn back a blanket of superstition and dogma in an inexorable progression toward truth and rationality.

Yet according to Foucault (1966), this homogeneous representation of history as a linear accumulation of knowledge masks periods of fundamental discontinuity. It also fails to consider how ideas are produced and understood in different periods. By shifting perspective in this manner, he claims, several overarching conceptual frameworks or epistemes come into focus. Each describes a social a priori or governing syntax that proceeds and sustains all thought. Within these world views, various rival theories can then be valued and judged for their adequacy in solving the problems that are socially perceived. However, there can be no rational communication between the incongruous ideas of successive epistemes, for it is only within a conceptual system that questions of truth and falsity can be decided. For this reason, Foucault considers his inquiry a form of archeology, a piecing together of an internal order from the surface remnants of a given mode of thought. Like Durkheim, Foucault is concerned with the emergence of the human sciences, he chronicles the development of those areas of inquiry that incorporate some notion of the subject. In particular, he describes the view of the subject implicit in the changing theories of language, economic exchange, and biology since the middle ages.

According to Foucault, the past 500 years have witnessed four major epistemes. The first, the Renaissance, marks a departure from the Middle Ages and a world laden with theological significance. The individual's role at this point was simply to follow the instructions laid down in the great texts of antiquity and to interpret the messages that God had left in the natural world. There could be no science of the subject during this era, for the identity of the individual did not enter into the epistemological equation. Everything within this world was provided by the benevolence of God. The power of this conceptual framework can be seen in what we now would regard as the blind obedience to the word of ancient authorities, even in contexts where there seemed to be a clear and direct contradiction with empirical reality, for example, the rejection of Galileo's experiments that empirically contradicted Aristotelian mechanics and the teachings of the church, and the investigations of the surgeons of Padua who discovered that the function of the heart and the circulatory system did not follow the description laid down by Galen (Mason, 1962). Yet by the end of the 17th century, the success of the natural sciences were undeniable. The power of prediction they afforded over the environment suggested the human intellect as a source of understanding. With the emergence of the classical episteme and the Cartesian revolution, the subject now was credited with the ability to comprehend the world through reason. A sharp bifurcation was thus wrought between subject and object. To be intelligible, the object must be perspicuous to the subject, so this world view employs the metaphor of vision and characterizes the mind as a kind of mirror through which we see the structures of reality. According to Foucault, classical economic theories were based upon ideas about wealth and property and the need to own land and other observable goods. The animal and plant kingdoms were classified in terms of their external configurations, and language was seen as a simple translucent medium that enabled individuals to communicate their thoughts socially without distortion. This episteme was a period devoted to categorization and taxonomic recording of information, representing the world as independent yet transparent to the mind. The optical image implies that theorists classified only what was superficially apparent. A century, later further advances in the natural sciences suggested that reality was not composed of simple mechanical interactions but of a series of hidden forces existing below the surface of the observable world. Although the actions of electricity, magnetism, gravitation, and heat could not be viewed directly, their existence could be inferred from their effect upon objects. The mirroring model of mind was no longer adequate as an epistemological orientation, and the new modern episteme arose to take the place of the classical period. As Foucault (1966) explains, biologists like Cuvier now categorized species on the basis of their inner functions rather than their external appearance. With Marx, economic exchange came to be seen in terms of the underlying determinants of labor and production. In linguistics the vision of a single system or collection of terms was overthrown as the science of philology emerged. Now each language, like each animal species, was investigated for the peculiarity of its inner organization as a key to its historical and evolutionary success. Rather than a simple medium for the transmission of thought, language now was given a life of its own, with complexities and rules of organization that the average speaker never comprehends.

In all, this penultimate epoch offers an existentially frightening view of the subject. The new-found autonomy deserts the individual who is reduced to the product of impersonal and imperceptible forces. An object like any other, the subject is forced to obey laws beyond its control. However, the modern period does permit the subject to occupy the stage for one last encore. As Foucault explains it, the subject retreats into a new conception of itself as a being with a psychologically independent consciousness. In this private realm, convinced of its own independence, the subject becomes liberated from the forces that seem to control external reality. But this is the subject's last "hurrah," for with the advent of the fourth structuralist episteme, even this inner experience is proven an unreliable basis for understanding behavior. Freud's psychoanalysis and Lévi-Strauss's ethnological anthropology both illustrate that the subject's self-conscious explanations cannot fully explain human action. To both of these structuralists--and to Foucault (1966)--personal motives and social organization must be studied at the level of the unconscious. The notion of an independent subject in an objective world has finally been overturned, and with this the structuralist eipsteme completes the work of the classical period by adding the "death of man" to the "death of God."

> Among all the mutations that have affected the knowledge of things and their order . . . only one, that which began a century and a half ago and is now perhaps drawing to a close, has made it possible for the figure of man to appear. And that appearance was not the liberation of an old anxiety, the transition into luminous consciousness of an age old concern, the entry into objectivity of something that had long remained trapped within beliefs and philosophies: it was the effect of a change in the fundamental arrangements of knowledge. As the archaeology of our thought easily shows man is an invention of recent date. And one perhaps nearing its end.
>
> If those arrangements were to disappear as they appeared, if some event of which we can at the moment do no more than sense the possibility--without knowing either what its form will be or what it promises--were to cause them to crumble, as the ground of classical thought did, at the end of the eighteenth century, then one can certainly wager that man would be erased, like a face drawn in the sand at the edge of the sea. (pp. 386-387)

As far as Piaget is concerned, Foucault's concept of an episteme fails to capture the constructivist nature implicit in an authentic structure and thus reduces the history of science to a tale of irrationality. For Piaget, the episteme is limited in two respects. First, unlike his own biological model of structure, which is defined in terms of the intrinsic need for adaptation, the episteme contains no inherent purpose and no component to direct the development of knowledge toward truth. Second, as Piaget (1970) recognizes, the episteme exists in language, culture, and ideology rather than the cognitive mechanisms of the subject.

> Everyone grants that structures have laws of composition, which amounts to saying that they are regulated . . . to be real, a structure must, in a literal sense, be governed from within. So we come back to the necessity of some sort of functional activity; and, if the

> facts oblige us to attribute cognitive structures to a subject, it is for our purposes sufficient to define this subject as the center of functional activity. (p. 69)

In contrast to Foucault's episteme, Piaget proposes to explain the growth of scientific knowledge through the historically emerging "mental structures" of the epistemic subject. While he does not claim to predict the role that cultural, ideological, and economic forces might play in directing inquiry, he remains committed to the belief that a law of cognitive organization can be found within any such socially defined matrix. Just as equilibration cannot be factored out of psychogenesis, so Piaget maintains that the development of knowledge toward truth can be fully explained only through the process of adaptation. To repeat the central thesis of genetic epistemology. The same necessary law or organization can be observed at all levels from the biological realm through the problem solving activities of children to the historical construction of reason. The epistemic subject is thus Piaget's generalized structuring agent--a competence model of a universal intellect--logically constructing more objective concepts according to the dialectical logic of experience within the historical context of thought in which ideas are presented.

Piaget chooses the model of the mathematical group rather than the concept of langue to represent an organized system because he is committed to the view that structures must have a structuring tendency. That is, the epistemic subject has a propensity to establish equilibrium within experience. Piaget attempts to formulate a mathematical description of this functional mechanism in the second phase of his constructivist theory. As I will show, his essential project is to explain an internal logic that will direct the development of the epistemic subject to produce increasingly objective structures. The chief problem Piaget faces in this endeavor is to provide an explanation of how the adaptive behavior of a subject can lead to normative changes. I shall now turn to this question and Piaget's logic of the historical development of knowledge.

Function

According to Piaget (1970) all structures have a genesis that resides in a previous structure. The child's first action schemes (e.g., sucking, grasping), which provide the basis for concrete and subsequently formal operations, themselves are founded upon the inherited reflexes of the baby. (These are initial pre-cognitive structures that have been acquired by human beings during the course of evolutionary history.) By assimilating new objects into such existing schemes and accommodating these structures to fit novel experiences, new equilibrated systems of action are formed, a process that extends sensorimotor schemes in generality and applicability from the immediate environment of the infant to incorporate all possible experiences in the abstract structures of adolescent thought. As Piaget (1971) argues, it is only with the eventual achievement of this universality that the subject's reasoning acquires the necessity implicit in Kant's categories.

> Now observation and experiment show as clearly as can be that logical structures are constructed, and that it takes a good dozen years before they are fully elaborated . . . through the interplay of reflective abstraction . . . which furnishes increasingly complex "materials" for construction, and of equilibration (self-regulation) mechanisms, which make for internal reversibility, structures--in being constructed--give rise to that necessity which is apriorist theories have always thought it necessary to posit at the outset. Necessity, instead of being the prior condition for learning, is its outcome. (p. 62)

Not only does Piaget believe in the construction of necessity, but he also thinks, like Hegel, that progress toward this end is necessary. That is, the epistemic subject, like spirit, constructs reason through a rational process. A fundamental but subtle distinction will help to clarify this argument. When Piaget describes the development of thought, his primary concern is not with the "mechanical" causes that generate individual or historical change (these are interesting but secondary questions) but rather with the reasons for epistemic advancement. Piaget recognizes that social factors may cause a retrogressive phase in scientific thought (e.g., Aristotelian science), just as certain environmental influences may inhibit the intellectual progress of the psychological subject. However, since the chief objective of Piaget's (1951) genetic epistemology is to explain the development of scientific knowledge toward truth, his interests lie with the logical relationships that exist between structures and the process by which new sets of concepts are related to those of a previous level. So, in contrast to Foucault (1966) and Kuhn (1966) who reject any continuity in conceptual change and explain the passage from one episteme or paradigm to another through a "rupture" or "revolution" in thought, Piaget claims that emerging schemes are logically implied by earlier ones.

The key to understanding this rational construction is Piaget's dialectical mechanism of equilibration. This consists of two phases of thought (Piaget & Garcia, 1986). First is an initial period of homeostatic equilibrium, somewhat similar to Kuhn's normal science, in which reason operates deductively from a given conceptual scheme, and second are implicit contradictions within understanding that initiate a period of dialectical construction. Like Hegel, Piaget believes that concepts break down before thought, and in a process similar to determinate negation (supra, pp. 106-116), new more reversible structures are developed. It is not that one set of concepts simply replaces another, but rather that the limitations experienced in one structure logically imply the development of a new non-contradictory system. Again, this depassment, like Hegel's aufheben, learns from the past, preserving the initial structure within a new construct.

Piaget (1980b) describes this mechanism on three levels: the biological "phenocopy," the psychological process of concept formation through reflective abstraction, and, in the history of science, the construction of theories. In each case fixed elements at one level are projected as possibilities onto a higher stage, a generalization of form into content that opens up new implicatory relationships that then are integrated within a more abstract organization. As Piaget and Garcia (1986) explain this process in the cognitive domain,

> reflective abstraction . . . proceeds from the subject's actions and operations, according to two processes that are necessarily associated: (1) a projection onto a higher level (for example, of representation) of what is derived from the lower level (for example, an action system): and (2) reflection, which reconstructs and reorganizes, within a larger system, what is transferred by projection. This reflection is a constructive process, for two complementary reasons. First, projection essentially establishes correspondences at the next higher level, associating the old contents transferred from previous levels with new contents that can be integrated within the initial structure but permitting it to be generalized. Second, these first organizations also lead to the discovery of related contents, which may not be directly assimilated into the earlier structure. This makes it necessary to transform that structure by means of a constructive process until it becomes integrated within a larger, and therefore partially novel, structure. This mode of construction, by reflective abstraction and "constructive generalization," repeats itself indefinitely, at each successive level, so that cognitive development is the result of the interactions of a single mechanism--one, however, which is constantly renewed and extended by the addition of new contents alternating with the creation of new organizations of structures. (p. 274)

Unlike causal explanations implicatory relationships cannot predict future developments. In fact, a variety of logical structures may be entailed from the contradictions within a system. Hegel recognized this in the Phenomenology when he denied that the successive moments of consciousness could be determined through a mathematical formula (e.g., Fichte's triadic form). Even so, reason does have a natural and obvious course of action, namely to suggest an hypothesis that overcomes the problems implicit within the present stage. For example, when Sense Certainty finds that it cannot explain particulars without employing universals, Perception develops the theory that particulars can be known only through universals.

As I argued in Chapter 2, spirit is not tied to a particular path in the historical development of consciousness. Hegel could have started the Phenomenology with Perception and have followed a radically different course in his deduction. The same principle holds for Piaget's account of rational development. Future concepts cannot be anticipated, for new epistemic structures are the creative product of thought. The only requirement of this open-ended process is that subsequent stages are more equilibrated and therefore are more objective than earlier ones. Above all, Piaget, like Hegel, must not be interpreted as implying that science will unfold in a determinate manner, as if there were only one solution to the problems of experience. Indeed, in their examination of Chinese science, Piaget and Garcia (1986) recognize the existence of multiple branches in the history of thought, but like Hegel believe that these paths eventually will converge as concepts approach the properties of reality.

Nonetheless, within all possible courses of development, both Piaget and Hegel identify three broad progressive moments of reason. For Hegel these were theories of knowledge based on the object, the subject, and the immanent relationship between the two. Similarly, Piaget discusses the development of scientific theories in terms of the "intra," "inter," and "trans" relations. In an hypothesis reminiscent of Comte's three stages of thought (Manicas, 1987), Piaget and Garcia (1986) explain how reason moves from an initial concentration upon objects to their transformation and then finally to the integration of such operations within a total system of rules.

> The intra phase leads to the discovery of a set of properties in objects and events finding only local and particular explanations. The "reasons" to be established can thus

> be found only in the relations between objects, which means that they can be found only in "transformations." These, by their nature, are characteristic of the inter level. Once discovered, these transformations require the establishment of relations between each other, which leads to the construction of "structures," characteristic of the trans level. (pp. 273-274)

It is interesting to observe that whereas Hegel boldly claims to have completed history, Piaget with typical humility, recognizes that genetic epistemology, the science of knowledge, has attained only the level of an interfactual study. It has not yet achieved the transfactual stage of mathematics where every element can be deduced from an overall model.

The parallels that Piaget wishes to establish cannot be drawn at the level of content. Clearly the different theories of mechanics developed by early Greek and Chinese scientists must be understood in relation to the distinctive social, economic, religious, and political conditions that sustained their inquiries. These external forces exert a powerful influence on the course of scientific thought, and Piaget explicitly recognizes that the advances of every era must be judged in terms of such evolving "ideological" needs. However, within this socially determined milieu, scientists also address internal "cognitive" questions. Since the choice of any new theory, whatever its concern, raises conceptual problems in relation to the received epistemic scheme, Piaget claims that the ensuing constructive process--at all stages in the history of thought--obeys a single law of development. That is, Einstein, Newton, Descartes, Aristotle, pre-historic humans, adolescents, and sensorimotor infants all employ an identical logic of organization in the construction of new levels of understanding. The isomorphisms that Piaget and Garcia (1986) wish to establish between the psychogenesis and the sociogenesis of mind thus relate to its mode of construction. Their aim, like that of Karl Popper (1979), is to demonstrate "that the spontaneous development of knowledge has its source in biological organizations and tends towards the construction of logico-mathematical structures" (p. 274).

Two important conclusions can be drawn from these considerations of the dialectical method and apply equally to both Hegel's and Piaget's arguments. First, although development cannot be predicted in advance since it moves logically rather than causally, it can be justified retroactively by explanations of the form: "stage n+1 emerged from stage n through the construction of the following concepts. . . ." Second, while the end of development, its telos, is not known from the outset, the dialectical process "presses" thought towards the truth. For Piaget this teleonomic orientation--or vection--is the orthogenetic principle that guides the equilibration process toward objectivity and, like Hegel's dialectic, steers a middle path between vitalism and mechanism. So unlike Popper's (1979) concept of "verisimilitude," which describes the movement toward truth through an external "Darwinian" process of selection, the dialectical argument adopted by Piaget explains, but cannot predict, the rational development of mind as a process of learning from experience.

If this dialectic of concepts explains why reason must advance in a rational manner, an account of the motive force behind this change also is required. Why, that is, must thought be pushed to higher levels? Hegel's answer was that reason has an intrinsic drive to comprehend the truth of experience. This internal purpose is compared through the bildung metaphor to the striving for life in a living organism. Spirit cannot rest until it achieves total comprehension. Piaget also provides a biological explanation for the development of reason. But unlike Hegel, who presented a philosophical examination of consciousness, Piaget seeks to explain the development of knowledge scientifically through a causal model of evolutionary adaptation. Piaget's argument is thus that reasons can be given for epistemic change because structures develop logically toward objectivity and, therefore, truth; the need for adaptation causes the behavior that generates this rational development of mind.

The Equilibration Model

How can behavior cause adaptation? The Darwinian thesis explains evolution through random mutations at the level of the genotype and accounts for the adaptation of the phenotype in terms of the post hoc "survival of the fittest" principle. That is, the population genome does not learn from experience. In contrast, Piaget proposes an interactive model in which the genotype can acquire traits from the phenotype.

Although Piaget developed his own ideas of this process, he saw a fully elaborated concept of this causal mechanism in Waddington's (1975) theory of epigenetic assimilation. Briefly, whereas the traditional Darwinian hypothesis attempts to explain change through the mutation of genes within the subject, Waddington argued that development must be viewed in the context of the interactive matrix that exists between the phenotype and the genotype. Within this epigenetic interpretation, the phenotype is constructed out of a mix of genetic and environmental information. Typically the organism will follow a highly probable pathway, or "chreod," on its course to adulthood. However, since it is possible that an organism's behavior may alter its environment in developmentally significant ways, new more probable chreods can emerge that are sympathetic to subsequent mutations. In short, phenotypic changes can alter the genotype.

While this was the equation Piaget needed for his tertium quid, it is important to recognize several fundamental differences between Waddington's ideas and his own. For example, Waddington's arguments are directed at species-level changes that occur over several generations (Rotman, 1977), whereas, in contrast, Piaget seeks to explain how an individual's actions can lead to a genotypic inheritance. Further, Waddington's theory must be viewed as an extension of the Darwinian thesis. For although epigenetic assimilation explains the emergence of more equilibrated systems, it remains incompatible with Piaget's belief in a logic of development. Growth is still based upon the mutation of genes, and change is not regarded as the progression toward perfection that Piaget wishes to establish.

Since Piaget's (1980) theory of adaptation demands that structures "learn" from experience, he remains committed to the view that the genotype must take information from the phenotype. Although this "speculative hypothesis," the principle of "phenocopy," has yet to receive empirical support, Piaget's (1980b) own scientific experiments on the process of adaptation lead him to suggest the existence of some mechanism by which the RNA proteins can, in certain cases, requalify DNA molecules.

> This interpretation of the phenocopy is basically constructivist in nature. The new genotype constitutes the ultimate result of conflicts and interactions between organism and environment, and the environment thus necessarily intervenes as one of the transforming elements in its causality. If this is so (and here lies the constructivism), then the adaptation itself has, as its producing factor, not the environment as such, but rather the constant action of the organism on the environment. (p. 73)

For Piaget, all life is driven by the process of auto-regulation and the tendency toward stability through the creation of new structures. But if this is so, how does a system "know" which way to develop if it is to "learn" from experience and find a greater degree of adaptation? According to the Darwinian thesis, the criterion of success--survival--is external to the system. In contrast, for Piaget the system must be able to recognize a superior organization internally if progress is to be possible. He thus proposes two tendencies that he believes all biological structures must incorporate to secure their stability. First, structures must open beyond their immediate environment to achieve a greater command of experience. Second, an organism must become independent or self-sufficient by integrating structures into more complex wholes.

To explain the dynamics of this development, Piaget turned to the work of Ludwig von Bertalanffy (1968) and the emerging sciences of cybernetics and systems theory. Bertalanffy had developed laws of organization to characterize both the "closed" mechanical environments of isolated groups and the more "open" or organismic structures that interact with their surroundings. Whereas the first class of systems obey the second law of thermodynamics and approach a state of entropy or static equilibrium, the latter through their interchanges with exterior elements tend like biological organisms to acquire order and form. Piaget thus adopted Bertanlaffy's laws of organization and explained the process of auto-regulation in terms of cyclic feedback circuits, which through negative and positive reinforcements promote and check the opening and integration tendencies within the structure. This model of cyclic causality enables Piaget to frame laws of development that are intrinsic to life itself. In discussing Bertalanffy's ideas, Piaget (1971) says, "the great merit of his organicism is . . . that . . . it showed some realization that there was a place for some intelligible theory of totality between the two extreme alternatives of mechanism and vitalism." (p. 154)

To recall Piaget's (1971) hypothesis, the equilibration process leads from biological structures to cognitive structures and then on to mathematical knowledge. Each of these stages, it will be observed, is fundamentally different. Biological systems are physically embedded in the world, whereas cognitive schemes achieve a degree of independence through the coordination of actions. Only mathematical knowledge attains a "pure state" by constructing operations based upon operations rather than physical elements. (The whole sequence, of course, is an instance of Piaget's analysis of development in terms of the intra, inter, and trans relations.)

Clearly Piaget does not think that cognitive processes are a subspecies of biological processes, as many of his critics seem to interpret him as implying (e.g., Sugarman, 1987). The concepts of assimilation and accommodation, for example, are based upon a parallelism rather than an equivalence between biological and cognitive systems. Piaget does not believe that we acquire knowledge in the way that our stomach ingests food. Further, cognitive structures do not pass on information genetically and are not tightly controlled by inherited characteristics. Yet, with these differences in mind, Piaget believes that the organizational similarities between the organism-environment system and the knower-known relation are striking. Isomorphisms exist between the dialectical cybernetic feedback mechanisms in both domains (opening and integration at the biological level and assimilation and accommodation in the cognitive domain). At each stage, development is explained through the construction of endogenous structures (genotypic and logico-mathematical laws) from exogenous forms (the phenotype and physical knowledge). The biological principle of phenocopy is replaced by the "cognitive phenocopy" (reflective abstraction) and the process of equilibration that leads the organism to a higher degree of adaptation now pushes thought towards the truth. As Piaget (1980b) explains,

> in what follows, we shall use the phrase "phenocopy" in the broad sense for the replacement of an exogenous formation (phenotypic or cognitive, and due respectively to environmental action or experience of external objects) by an endogenous formation (due to the activities of the organism or the subject). . . . In the case of biological phenocopy, the endogenous formation which replaces the simple phenotypic adaptation consists of a new genotype, and thus of a form developed within the genome and capable of hereditary transmission. As far as intelligence is concerned, on the other hand, we understand by "endogenous" only those structures which are developed by means of the regulations and operations of the subject . . . such constructs are not drawn from external objects, but arise from internal logico-mathematical activity engendered by the coordination of the individual's actions . . . It is likewise understood that the term "exogenous," when applied to knowledge, will indicate that it is derived from physical experience. (pp. 80-81)

In sum, Piaget's equilibration process is not specific to either biological or cognitive forms, but should be viewed as a general law of self-organization within an open system. It expresses in functional terms the changes that must occur between the parts and the whole of a structure if a disequilibrating experience is to be overcome through adaptation. These laws are internal to the system, but they are not derived through maturation. Nor are they copied from experience. Indeed, the role of experience is merely to act as an obstacle to the system, which through internal requalifications will establish a more comprehensive and complex set of relationships leading to a superior form of equilibrium. Piaget's theory of genetic constructivism is thus an attempt to formulate the logic of self-organization.

It is important to recognize the context of Piaget's arguments for the equilibration model. Often critics represent his theory as if this process was the only factor involved in development, contrasting it with empirical views of social learning or a priori theories of maturation. For Piaget the law of development is just one element in a matrix of necessary conditions. In the cognitive domain, for instance, unless the subject is able to mature physically, learn from the environment, and interact socially, intellectual growth is impossible. Yet, these conditions still are not sufficient, for according to Piaget's epistemological arguments they cannot on their own explain the necessity and universality of knowledge. Even so, Piaget shows little interest in dividing and assessing the role each of these factors play in the developmental matrix. He recognizes both that "growth has its own rhythm" and that an enriched environment may accelerate development to some degree, (an issue he calls "the American question"), but he maintains that his theoretical interests lie with the process of adaptation. As an epistemologist concerned with the objective nature of knowledge, he argues that these other conditions, however essential, cannot explain the development of reason. Only by introducing the factor of equilibration can these various components be organized within a system that satisfactorily accounts for the facts of intellectual and biological evolution. Piaget (1980a) emphasizes that this commitment marks the chief difference between his own and Chomsky's theory of growth.

> What especially bothers me about the innateness hypothesis is that the current explanations of the neo-Darwinians concerning the formation of any new character trait in the organism are based solely on notions of mutation and selection. Now, a mutation necessarily occurs at random; therefore, if there were innateness, reason and language would be the result of selected accidents, but selected subsequently, after the fact, whereas the formation itself would be the result of mutations and would therefore occur at random. I claim that in that case, it would be tantamount to shaking the solidity of knowledge, instead of consolidating. . . . I absolutely refuse, for my part, to think that logico-mathematical structures would owe their origin to chance; there is

> nothing fortuitous about them. These structures could not be formed by survival selection but by an exact and detailed adaptation to reality. (p. 59)

To summarize, in Piaget's (1950) view theories of knowledge based upon the social transmission of ideas are no more plausible than Chomsky's maturationalist account in their efforts to explain the origin of thought. With the additional failure of empiricism to account for the necessity of logico-mathematical concepts, Piaget (1950) concludes that the fourth epistemological factor, equilibration, must be invoked to explain the genesis and structure of knowledge. In his efforts to describe this self-generating adaptive process Piaget has conducted numerous psychological studies that focus on this mechanism by minimizing the effect of the other three components of development. As a consequence, critics unfamiliar with Piaget's epistemological concerns may well interpret his explanations as being socially, environmentally, and maturationally insensitive. Yet as Chapman (1988) argues, Piaget's experimental indifference to these necessary conditions does not imply any limitation in the principles of genetic epistemology, for

> although the claim that Piaget neglected these factors can certainly be justified, one should consider the reasons for his neglect. In particular, one should consider how his theory was "biased" by the particular questions he sought to answer and to what extent the factors he thereby neglected could be integrated into the theory without changing its basic assumptions. (p. 369)

The most commonly voiced criticism of Piaget's theory addresses the apparent underevaluation of social factors in his account of intellectual development (e.g., Atkinson, 1983; Boden, 1979; Hamlyn, 1978; Rotman, 1977). As Hamlyn (1983) observes, any explanation of how children acquire knowledge of the world must recognize that concepts, judgments, and criteria of truth are socially and not individually constructed.

> The objectivity of a concept is bound up with the idea that it must be inter-subjective, inter-personal, just as knowledge is. Hence, it is impossible to look on the growth of knowledge as some kind of transaction between an individual and his environment, as if social interpersonal factors had no part to play. I have commented already on the serious underestimation of the social in Piaget's thought. This is home out by his adoption of this curious biological mode, which effectively rules out the social factor, and thereby undermines the objectivity of knowledge. (p. 86)

According to Hamlyn (1981) Piaget only pays lip service to the social component of development, regarding it

> as simply one aspect among others of the individual's relation to the environment. A cognitive individual must already be social if it is to have any genuinely cognitive relationship with the environment, and the social cannot be simply added on to whatever cognitive relations with environment already exist. (p. 118)

In response to such criticisms, sympathetic readers like Chapman (1988) and Kitchener (1981) claim that far from underestimating social factors, Piaget's theory actually is a social theory of knowledge and not the individualistic account that Hamlyn pictures it to be. In order to support this interpretation Kitchener (1981) discusses a number of early untranslated and "virtually unknown" articles that Piaget composed on the logic of social exchange. As Chapman (1988) admits,

> it is certainly true that Piaget wrote relatively little about sociology or social development after 1950. One can read many of his major works on cognitive development without running across more than token acknowledgements of the importance of social factors in development. Thus one can easily arrive at the conclusion that he did not consider those factors at all. (p. 150)

Yet both Chapman and Kitchener believe that these early sociological writings establish the social character of intellectual development and thus provide an epistemologically sound framework within which Piaget's later, more technical, studies must be read. Thus, from the perspective of these foundational arguments, the popular criticism of genetic epistemology as a process of individual construction is simply misplaced. As Chapman (1988) quotes Piaget, "the individual can only achieve his inventions and intellectual constructions insofar as he is the set of collective interactions that are naturally dependent, in level and value, on society as a whole." (p. 371).

Although many critics will no doubt welcome this social grounding of the epistemic subject, others like Gellatly and Rogers (1988) remain skeptical, questioning the continuity of Piaget's studies across 50 years of research. "Piaget, too, recognized the importance of social context for cognitive development but, as is well known, in his later, more influential work this insight was almost wholly eclipsed." (p. 1). A clear problem of interpretation thus emerges. If Chapman (1988) and Kitchener (1981) are correct in arguing that Piaget views the subject as a social construction, it remains to be explained why there has been decades of confusion over the meaning of his studies. To claim that Piaget's attention was directed toward the specific task of uncovering the mechanisms of the equilibration process and away from the basic principles of genetic epistemology ignores the many books and articles Piaget wrote in order to introduce his ideas to a larger audience. In these popular works Piaget had the opportunity and the responsibility to answer his critics by affirming the social origin of thought. His silence on this pivotal issue remains perplexing, and in my opinion at least, despite the arguments of Chapman and Kitchener, renders his exact position on the social nature of mind an open question.

However, there is one theme that runs continuously throughout Piaget's writings, from his youthful insights in Recherche to his last psychological studies and biological speculations: namely, that a single logic of organization governs the progressive development of structures in all domains. In the articles that Chapman (1988) and Kitchener (1981), cite Piaget applies his principles of adaptation to explain the coordination of values, norms, and economic exchanges within society.

> Following 19th century evolutionary thinkers such as Spencer and Comte, Piaget believes the course of development (in all spheres) can be characterized by a single orthogenetic principle (increasing equilibrium) and that this principle is both rational and good--since it is the goal of development. (p. 271)

Piaget thus believes that the coordination of actions between individuals establishes systems of relations that share the same formal properties as the structures found in cognitive development. In his later works Piaget attempts to define these logical operations through the abstract laws of systems theory and cybernetics. His aim is to isolate the fundamental principles of organization and present equilibration as a necessary component of development independently of the structures host.

Yet as Kitchener alluded, this project seems to be little more than an effort to dress a 19th century metaphysics in the language of 20th century logic. For despite Piaget's lifetime campaign to demonstrate the existence of this internal dialectic in the biological, psychological, social, and epistemic fields, his arguments have failed to convince more than a handful of specialists within each of these areas. Most theorists accept the simple truth of history, that there is no inner organization controlling the development of knowledge, anymore than there is an implicit direction to the evolution of life. Despite Piaget's elaborate mathematical structures, his efforts to establish a tertium quid between a priorism and empiricism appear to rest more on a metaphysical commitment to an inner logic of development than they do an analysis of either biological processes or the origin of concepts. Piaget thus comes under attack from socially minded critics like Hamlyn (1978) who see little difference between the necessity explained by the equilibration mechanism and that established in Chomsky's notion of an innate "nucleus." Haroutunian (1983) also comes to this conclusion through a careful examination of the phenocopy principle. In essence, she argues that the only kind of learning that such a system of rules can achieve is the sort of hypothesis testing described by Fodor. Since reflective abstraction implies a reorganization of existing structures into a new structure, then both the elements and rules of combination must exist already within the system. In short, "the feedback operation cannot explain how new possibilities for cognitive structure enter the repertoire" (p. 80).

To meet this objection and to avoid a reduction of his tertium quid into a priorism, Piaget must explain the sense in which a new structure may be generated without being virtually present in its parent stage. The details of Piaget's argument depend upon the domain in which the law of equilibration is applied. In the case of biological structures, for example (which are purely physical), a causal explanation is demanded. If the question concerns the development of mathematical knowledge, a rational account is required and equilibration will be explained in terms of reasons. These two domains are less problematic than the cognitive, to which Haroutunian's question is addressed. For in this case Piaget is faced with the task of justifying intellectual growth in terms of both reasons and causes. That is, he must use the equilibration mechanism to explain causally why cognitive development leads to rational thought. Put otherwise, psychological growth must satisfy both mental and physical laws in the continuous growth of structure from biological reflexes to mathematical operations.

To understand Piaget's argument, two forms of psychological inquiry must be distinguished: developmental psychology, which is concerned with the growth of the epistemic subject, and so like the historico-critical method phrases its explanations in terms of reasons; and child psychology, which, in contrast, centers on the individual's development. Like the external and internal histories of science, this will involve both causal and rational descriptions. Psychology in this latter sense is defined by Piaget (1950) as the science of the implicatory. By this he means that mental representations including thoughts like "2+2=4" can be analyzed logically with respect to the meaning of its terms and causally through a physiological account of the brain states that support it. Since Piaget wants to avoid both "logicism" and "psychologism", he argues that each of these explanations are independent and irreducible. Piaget's answer to the mind-body problem is thus a form of parallelism or double aspect theory where rational and causal characteristics are seen as different faces of the same phenomena.

Initially, toward the biological side, the behavior of infants is described in terms of a "logic of action," whereas the construction of formal thought--and mathematics--is phrased as an "operatory logic." This gradual change of perspective is summarized by Piaget (1950).

> As the domain of equilibrium becomes enlarged from stage to stage, . . . that is linked to more extended anticipations, it is thus clear that this aspect of implication becomes augmented in importance with the development of behavior, while the strictly causal aspect (i.e., the real as opposed to the possible) diminished correlatively. This is why the psychology of behavior, which utilizes explications based at once on causality and on implication as far as elementary behaviors are concerned, becomes less and less causal and more and more operatory or implicative to the extent that it moves away from the primitive forms and approaches the final equilibrium. (p. 166)

I will now present a simple outline of Piaget's mature equilibration argument for cognitive growth. Since Piaget (1977) has devised a complex mathematical description of this mechanism, involving highly elaborate cybernetic feedback circuits, I can only recommend the reader to his later writings for a detailed account of this model.

For Piaget, cognitive structure operates like a deductive system defining what is necessary and what is possible within experience. For the young child early structures are based upon the figurative bias of perceptions. Tall, for example, ofte is equated with a large volume. However, within the system such "affirmations" must be completed by accompanying "negations," such as not tall means not large volume. The equilibrium of a structure at any time is based upon a balance between affirmations and negations. With experience, modal errors will occur in the child's reasoning, as what was initially thought to be necessary fails to happen, or what should be possible cannot be achieved. These "contradictions" may be due either to negative feedback (where an object cannot be assimilated or accommodated by a scheme) or a lacunae, a positive feedback that promotes a tendency finding no application. Such contradictions reveal the incompleteness of the system and demand new model definitions to resolve the conflict with experience. At this point, according to Piaget (1985), these "negations" must be "negated;" that is, not-tall is no longer seen to imply not-large-volume (although the affirmation remains true). This rejection of an existing scheme opens up all sorts of new possibilities that the child can explore. Since affirmations are more natural in thought (being closer to perception than actions), these will be considered first as a way to bring necessity to the confused experience. When they are matched by a corresponding negation, the next level of equilibrium will be achieved. However, there are certain constraints on the nature of these affirmations and negations. In particular, they must be combined to form a structure that retains existing schemes within a more coordinated system. This new set of necessities then will explain the success of previous affirmations along with their limitations. Volume does depend upon height, but it also is related to width. Piaget thus argues that the next level is implied by the existing one, in the sense that only certain structures can "overtake"--advance and retain--present schemes. Cognitive change is therefore caused by conflict and resolved, sooner or later given the appropriate conditions, by an implied structure.

Piaget (1977) presents an abstract account of these cybernetic circuits, extending hierarchically from biological to mathematical structures in a continuous flux of constructive development. In all domains the equilibration process overcomes contradictions within experience by defining necessary adjustments and compensations that lead to the construction of more encompassing schemes. Phylogenetically, this implies the rational development of reason, represented by the growth of the epistemic subject, while ontogenetically the individual approaches rationality and the level of scientific thought. In the most general terms, the equilibration process is defined through the replacement of exogenous content with endogenous form. This logic of self-organization is achieved in the biological domain when the genotype copies phenotypic traits, in the cognitive domain with the construction of reflective abstractions from the information provided by empirical abstractions, and in the field of knowledge by the replacement of theoretical terms by observational ones, again through the same process of reflective construction.

The Empirical Verification of Genetic Epistemology

If Piaget's hypothesis is correct, then a parallel should exist between the individual's development of concepts and their historical emergence in scientific thought. Piaget (1950) describes this isomorphism globally, in what he terms "generalized" genetic epistemology, by equating the sensory motor, concrete, and operational stages with the levels of thought acquired by anthropoids, pre-Socratic thinkers, and the ancient Greeks. More specifically, in "restricted" genetic epistemology, Piaget also traces the symmetrical development of scientific concepts like force, velocity, and causality. An obvious problem arises, however, when these historical and psychogenetic studies reveal different lines of development.

In the Psychogenesis and History of Science, Piaget and Garcia (1986) focus upon such apparent anomalies within the equilibrium model. Recognizing the contemporary debate within the philosophy of science on the social foundations of knowledge, these authors attempt to prove their claim that the epistemic subject moves continuously and rationally toward truth and objectivity. Distinguishing their constructivism from the theories of Kuhn, Popper, Feyerabend, and Foucault, Piaget and Garcia accept the role of ideology in scientific inquiry but maintain that a genuine cognitive component exists within all forms of thought. Accordingly, they observe, the work of the equilibration mechanism can be only viewed within the context of each historical epoch. As Piaget and Garcia (1986) argue in discussing the concept of inertia,

> as a result, what is considered "absurd" or "obvious," relative to an epistemic framework is also partly determined by the dominant ideology. There does not seem to be any other way to explain the destiny of the principle of inertia in the Western world: absurd for the Greeks; a discovery of a truth inherent in the physical world for the seventeenth century; obvious and almost trivial for the nineteenth century (to the point where a student who would not "see" this principle as obvious would have been considered as seriously deficient); neither absurd nor obvious, neither true nor false for the twentieth century, since it is accepted only for the function is has in physical theory. . . . In our view, at each moment in history, and in each society, there exists a dominant epistemic framework, a product of social paradigms, which in turn becomes the source of new epistemic paradigms. Once a given epistemic framework is constituted, it becomes impossible to dissociate the contribution of the social component from the one that is intrinsic to the cognitive system. (pp. 254-255)

For Piaget and Garcia, therefore, Aristotlean mechanics can be seen as a progressive step in the history of science; once the details of the ancient Greek world view are taken into consideration. To repeat, the parallels to be drawn with psychogenesis do not concern the structure or content of thought but the functional relationships in the construction of concepts. Certain asymmetries between these domains are thus compatible with the equilibration thesis when the ideological background of development is explained. A far more perplexing case arises when the development of concepts found in psychogenesis reverses that found in histogenesis, once such example, "the genetic paradox of geometry," sits at the center of Piaget's studies. For here the historical sequence of spatial concepts is the converse of that generated in intellectual development.

As we have seen, a basic premise of Piaget's constructivism is that mathematical structures must arise out of a physical understanding of the world. Since there are no records pre-dating the empirical geometry of the Egyptians, Piaget attempts to trace the origin of spatial understanding through the emerging consciousness of the child. Historically, Euclidean geometry was the first to be formalized mathematically, followed by projective space, and then topological relations. Yet in his psychological research, Piaget found the opposite sequence in the cognitive development of the child. As infant drawings demonstrate, topological relations are the first to emerge, followed by an appreciation of perspective, and finally the coordination of viewpoints with the acquisition of Euclidean concepts. This movement traces the decentration from the subjective phenomenalism of egocentric perception to the fully reversible perspectiveless world of objective objects.

It is crucial to recognize just how important the question of space is to Piaget's system. Indeed, in many respects its role parallels Kant's form of outer intuition, since, as I described, this concept provides the basic structure of physical action and object permanence. The apparent anomalous development of spatial understanding not only calls into question the whole enterprise of genetic epistemology; it also undermines the equilibration process and the principle of orthogenesis. It is thus Piaget's coup de maitre to show that this inverse series of stages is exactly the sequence his theory predicts for the development of mathematical knowledge.

According to Piaget's principle of cognitive phenocopy, all mental structures are composed of logico-mathematical schemes produced through the process of reflective abstraction. In the case of mathematical knowledge, this process becomes a conscious introspection as thought requalifies its own actions. The first and most obvious structures to reflect upon are those that are the closest to our behavior, in this case the most developed schemes of thought. Piaget thus adopts Aristotle's dictum that the first in genesis is the last in analysis and argues that mathematical structures should reverse the order of the construction of physical concepts. This was no ad hoc explanation for Piaget, but an extension of one of the fundamental premises of his psychological studies, Claparède's law of consciousness. Briefly put, this rule states that thought, when unimpeded, is directed toward external events. It is only on the occasion of some obstacle to reason that subjects examine their thoughts and question the nature of their intellectual operations. While this remains an unconscious conflict during cognitive growth, it is elevated to a self-conscious activity of reason in the historical development of knowledge.

In the Grasp of Consciousness, Piaget (1976) attempts to bring out the self-conscious nature of mathematical reflections by renaming unconscious psychological abstractions "reflexive."

> It may be useful in this connection to introduce a distinction between not two types but two moments of the reflexive abstraction. It is, of course, an unconscious process and even constitutes one of the most deep-seated developmental factors, since it is the condition of all reequilibration. However, such a process can culminate in conscious and consequently conceptualized results. One can therefore talk of reflected abstraction, the term "reflected" simply designating the possible results, in the sense of a state, of the "reflecting" process, which is a transformation leading to this state. From such a point of view, the double relationship and the constructions to which it leads may be called reflexive abstraction. The whole history of mathematics is by contrast, that of reflected abstractions, which have long remained (as with the Greeks) in the state of products of an unconscious process (reflexive abstractions). Not until about the seventeenth century was mathematics incorporated into the realm of the reflected abstractions; some concepts, such as that of mathematical group structures raised to the level of reflected abstractions by Galois remained reflexive even longer. (p. 321)

For Piaget (1970), this postulated relationship between mathematics and psychological structures has received support from two separate projects: first, Felix Klein's Erlanger program (in which all geometries are represented in a hierarchial nesting of groups that gradually generalized the invariant properties of shapes under transformation, from Euclidean to topological space), and, second, the work of the Bourbaki group of mathematicians. As Piaget (1970) recalls from his meeting with Dieudonne, a prominent member of this society, both were astonished by the similarity of their respective inquiries. In attempting to rewrite mathematics in content independent terms, the Bourbaki identified three "mother structures": the algebraic group, structures of order (like the lattice), and topological relations. These in fact were exactly the same structures that Piaget had independently "discovered" in his psychological studies of intellectual growth. It is worth reading the conclusion that Piaget (1971) draws from this correspondence.

> Now when we study the intellectual development of the child, we find that the earliest cognitive operations, those which grow directly out of handling things, can be divided into precisely three large categories, according to whether reversibility takes the form of "inversion," of "reciprocity," or of "continuity" and "separation." Corresponding to the first--formally considered, algebraic structures--there are classificatory and number structures; correspondingly to the second--formally considered, order structures--there are series and serial correspondences; corresponding to the last--formally considered, topological structures--there are operations that yield classes, not in terms of resemblances and differences, but in terms of "neighborhoods," "continuity," and "boundaries." It is remarkable that, psychogenetically, topological structures antedate metric and projective structures, that psychogenesis inverts the historical development of geometry but matches the Bourbaki "genealogy"! These facts seem to suggest that the mother structures of the Bourbaki correspond to coordinations that are necessary to all intellectual activity, though they be very elementary, even rudimentary, and quite lacking in generality in the earliest stages of intellectual development. It would, in fact, not be difficult to show that in these very early stages intellectual operations grow directly out of sensory-motor coordinations, and that intentional sensory-motor acts--the human baby's or the chimpanzee's--cannot be understood apart from "structures." (pp. 26-27)

For Piaget the process of reflective abstraction explains the construction of mathematical knowledge through a retrogressive inspection of cognitive structures, which in turn depend upon the most basic forms of physical co-ordinations. Not only does this explanation solve the paradox of geometry, but it also provides a novel answer to the traditional debate over whether mathematical entities are created or discovered. Piaget accepts the truths implicit in both the traditional apriorist and empiricist arguments by showing that the mind invents mathematical knowledge out of what it discovers in its own intellectual structures. Moreover, since the evolved structure of thought ultimately finds its genesis in the logic of physical action, Piaget is able to explain how mathematics--in particular geometry--finds necessary application in the physical world.

For Piaget, as for Brunschvicg, mathematics provides a perfect expression of reality because it formalizes the logic of action that underlies all intellectual structures. Indeed, waxing metaphysical, Piaget and Garcia (1986) even argue, in a manner reminiscent of Hegel, that the world comes to know itself as the epistemic subject achieves "self-consciousness" in the laws of mathematics. This ultimate equation of mathematics with reality completes Piaget's youthful dream of an immanent epistemology.

In Recherche, Piaget (1918/1977) proposed a powerful image, a circle of sciences, that would unite all inquiry in a unified search for knowledge, both of ourselves and the world. In contrast to previous "one-sided" epistemologies, Piaget, like Hegel, sought to demonstrate the interdependence of the subject and the object within thought. The human mind, for all its achievements, must be viewed in the context of its evolutionary history, a continuous development that Piaget attempted to trace from the simplest form of biological organization to the level of logico-mathematical structures. The history of knowledge is thus a story about the immanent propensity of life to organize and create structures of meaning through the process of adaptation. The concepts that human beings develop are not copies from the external world, nor are they produced by the triggering of innate categories. The mind is not a mirror reflecting experience or an instrument that manipulates and organizes sensations.

For Piaget, all knowledge of the world is based upon the construction of action schemes and thus reflects both the properties of objects and the needs and desires of the subject. Consequently, if the mind attempts to discover the world through mathematics it will find that the laws of logic depend upon the psychological structures of the subject. Conversely, if the individual is studied in either psychology or biology, the role of the object must be recognized as a necessary component in the process of adaptation. As Piaget (1970) puts it, there can be no structures without genesis or genesis without structure, for it is always possible to explain logical schemes through the psychological laws that support their construction, just as such laws can be deduced through biological mechanisms, which in turn depend upon physical processes written in the equation of mathematics.

> The object is never known except through the thought of the subject, but the subject itself is not known except in adapting itself to the object. Hence the universe is known to man only through logic and mathematics, the product of his mind, but he can only know how he constructed mathematics and logic by studying himself psychologically and biologically, that is, in terms of the entire universe. (p. 118)

The point to learn from all this is that reason cannot break out of this circle of sciences to base knowledge on some secure foundation (either the a priori categories of thought or the structure of the external world) but must recognize the implicit definition of mind within life.

Conclusion

In this final section I will draw together my criticisms of Piaget's thesis and present the position of this dissertation. Even a casual review of the secondary literature generated by the Piagetian research program will convince the reader that genetic epistemology has generated and continues to wrestle with a plethora of specific challenges. Serious objections have been raised at almost every point in Piaget's immense catalog of development; biologists, psychologists, and philosophers all have taken issue with the aims, methods, and interpretation of Piaget's studies. While it is important to recognize these boundary debates over questions of detail, I will confine my criticisms to what I believe is the central weakness of Piaget's entire oeuvre: the commitment to development as an adaptive process of subjective construction. In particular, while accepting that Piaget's thesis is epistemologically sounder than the nativist theories of Chomsky and Lévi-Strauss, I shall argue that it remains fatally attached, as they are, to the Kantian view of the individual as the source of knowledge. This commitment leads Piaget to describe the process of evolution, intellectual development, and the history of science in terms of the socially impoverished concept of the epistemic subject. In what follows then, I will present parallel sets of arguments in each of these three domains to demonstrate the social component of thought impliciit in the historical development of mind.

As Rotman (1977) argues, very few biologists have taken Piaget's theory of adaptation seriously. He presents no clear evidence for the phenocopy principle and his belief that development progresses through the internal shaping tendencies of opening and integration stands in direct opposition to the received Darwinian thesis of post hoc selection. Indeed, quite remarkably, Piaget finds no role for this standard mechanism in his own theory of evolution, preferring to explain all adaptations in terms of the cybernetic auto-regulation structures of the organism. Yet even if this systems theory approach to development is accepted critics point out that Piaget's orthogenetic principle--the movement toward truth through stability of structure--remains underdetermined by the equilibrium mechanism. As Rotman (1977) argues, laws of increasing stability cannot specify either unique outcomes or an increase in complexity. So, while the horse may be a more complex and autonomously organized animal than the bee, it is not necessarily better adapted to its environment.

The central problem with Piaget's biological thesis, and in fact his whole theory of development, lies with his distorted interest in the structural organization of the individual organism. In contrast to the more orthodox focus on species behavior, Piaget thus poses the impossible task of explaining the adaptation of life through the development of physical structure. But as contemporary biology teaches, it is the actions of a population and not the morphology of organisms that determine the success of a species. In the end it is this neglect of the social in favor of the individual that fails, in the eyes of most critics, to establish Piaget's tertium quid as a real alternative to the Lamarckian thesis.

Since I have already presented my criticisms of Piaget's structural psychology of mind, I shall restrict my present comments to just two remarks about the subjective nature of his thesis. First, even if Piaget is correct in his characterization of the equilibration process as a self-governing logic of adaptation that guides the construction of the objective properties of the world in thought, we must not lose sight of the culturally defined nature of the physical environment. Almost all the objects that the developing child acts upon--including those in Piaget's experiments--are publicly manufactured in accordance with historically and socially evolved concepts and thus bear the intentional stamp of human purposiveness. At the very least, Piaget must recognize that the child subjectively reconstructs culturally determined properties and not those of an independent autonomous world, a realization that in part answers Kitchener's (1986) question of why a genius like Aristotle did not develop the scientific concepts of a modern adolescent.

Yet even this picture of intellectual development remains implausible. For within such a commonly defined environment it still seems highly unlikely that every child will independently construct the same sequence of conceptual stages. As the history of science demonstrates, there are numerous answers to the problems of experience. If children do in fact construct the world according to their own agency, one would expect intellectual development to follow as many different paths as the social history of ideas. To avoid nativism, therefore, Piaget must offer a more convincing explanation for the universal and necessary stages in the development of mind. My second point is thus to endorse one of the most commonly voiced criticisms of the equilibration model (e.g. Hamlyn, 1978), namely, that while Piaget pays lip service to the creative component in the constructive process, the invariant sequence of stages that the equilibration mechanism determines ultimately renders it indistinguishable from the fixed unfolding of a priori categories. So as Haroutanian (1983) observes, if the development of thought cannot follow alternative paths, Piaget's rhetoric aside, the mind must be structured from birth.

Piaget finds himself in this nativist regression because he is committed to the view that the orthogenetic principle--the norm of progress--is implicitly defined within the logic of organization. Since he also assumes that more adapted structures yield more objective judgments, he thinks this internal gyroscope is able to lead intellectual development to rationality, just as it steers scientific knowledge toward truth. But the equilibration argument incorporates a standard of progress, which, unlike Hegel's concept of truth, remains fixed through time and external to experience. The consequence is a theory of knowledge and an axiology of values based upon mathematical principles of organization rather than the historically evolving concerns of life. Not only does this model seriously misrepresent the common sense view of intellectual and scientific development, it also forges the tenuous equation of structure and adaptation with knowledge and truth. However, as I argued in my criticisms of Chomsky and Lévi-Strauss, the capacity to explain experience coherently and systematically cannot be invoked as a criterion of epistemological superiority.

If nativism is to be avoided without rejecting the universal nature of development, each person must learn a common system of concepts and norms. Thought cannot be explained as the outcome of private instructions but depends upon the inter-subjective agreement in judgments that forms the bedrock of language. The child's increasing understanding both of the world and its own subjective experiences thus is made possible through the acquisition of the socially evolved set of concepts encapsulated in everyday discourse. Accordingly, the development of the individual mind in part must be achieved through an initiation in the use of terms defined by what Wittgenstein (1958) called the "logical grammar" of concepts.

In Piaget's theory the individual does not emerge from but rather in opposition to the social. According to Piaget, children can develop only when they are challenged to face the limitations of their current conceptual schemes. Social interactions afford the best opportunity for such negative experiences, since in their contact with others the young are forced to entertain competing desires and viewpoints. Piaget believes that each subject, through his or her own agency, creatively generates new cognitive structures in response to a series of such disequilibriums. Taken to its logical conclusion, as von Glassfield (1979) does, Piaget's epistemology thus turns into a kind of solipsistic constructivism.

> Genetic epistemology entails a drastic break with the traditional conception of "knowledge" that can be interpreted from a "radical constructivist" point of view. This constructivist approach is "radical" because it embodies not only the view that cognition must be considered a process of subjective construction on the part of the experiencing organism rather than a discovering of ontological reality, but also the belief that there can be no rational access to any world as it might be, prior to, and independent of, our experience. (p. 109)

Yet as Haroutunian (1983) argues, intellectual development involves introducing children into the social view of right and wrong and training them in approved methods of problem solving, forms of cultural learning that cannot be explained by the equilibrium mechanism.

> For although interaction between persons and the environment is required, the interaction simply provides information about the adequacy of procedures and behavior patterns the system has. Thus one learns whether one's actions (procedures, etc.) meet one's own criteria for success. If the model were adequate, however, it would permit an account of how one learns a new behavior from others through a process of agreement, not merely by acquiring information about the success of behaviors already in one's repertoire. (p. 83)

Taken together, these twin objections demonstrate Piaget's serious underestimation of the social origin of mind. His model of autonomous subjects independently conceptualizing the properties of an external world misrepresents both the culturally impregnated character of experience and the public criteria of judgment employed in thought. As Hegel recognizes in his criticisms of Kant's subjective idealism, it is spirit (rather than the structured mind) that both defines the world and provides the epistemic principles for our knowledge of it. For Hegel, individuals are subordinate to the community, playing only an instrumental role in the larger socio-historical emergence of thought, such that the subject's ideas, acts, desires, and interests can be understood only within the context and movement of this social order.

It is worth pausing to appreciate the degree of Piaget's commitment to the individual, which, it seems, even extends to modelling society on the operations of a single mind. Against Durkheim, Piaget argues that social structures result from the actions of discrete individuals engaged in cooperative acts of exchange. The matrix of relations defined by these interactions then can be understood through the same laws of organization that are employed in the description of biological, psychological, and epistemic systems. For Piaget (1971), the organismic nature of life, cognition, society, and knowledge can be reduced to the operational structures of a single intellect, the epistemic subject.

> In the realm of knowledge, it seems obvious that individual operations of the intelligence and operations making for exchanges in cognitive cooperation are one and the same thing, "the general coordination of action" to which we have continually referred as being an inter-individual as well as intra-individual coordination because such "actions" can be collective as well as executed by individual. Here...the question whether logic and mathematics are essentially individual or social attainments loses all meaning; the epistemological subject constructing them is both an individual, though decentered in relation to his private ego, and the sector of the social group decentered in relation to the constraining idols of the tribe. (p. 360)

These comments bring me to my third set of criticisms that concern Piaget's arguments on the development of knowledge. Again I will limit myself to two objections, both of which are captured in Piaget's rejection of Foucault's (1966) archeology of the human sciences.

First, Foucault's (1966) analysis of history through a series of governing epistemes seriously undercuts Piaget's efforts to provide an internal logic of development. What Foucault's reconstruction of thought "through the eyes of the time" demonstrates is the clear and permeating presence of the social a priori in all aspects of life. These matrices of discourse, which lie beyond the individual in the cultural and ideological forces that shape human interests, define unique standards of rationality that mark radical discontinuities in the history of thought. Since Foucault finds no evidence of any overarching episteme or inter-epistemic dialogue, he concludes that the development of the sciences proceeds without purpose through a series of "ruptures" or "mutations." Faced with the dazzling erudition and compelling force of Foucault's arguments, Piaget and Garcia (1986) offer their own historical analysis of scientific concepts. These investigations, which typically focus on the development of fundamental mathematical and physical categories (e.g., space, velocity, and inertia) chart the broad logical relationships between the successive formulations of these ideas. While certain meta-theoretical regularities may be found in these conceptual hierarchies, for instance, Piaget's inter-, intra-, trans-sequence, it is not clear that such "laws" are either interesting or applicable to the description of scientific practice.

Like the psychological hypothesis that complex arguments are harder to understand than simple assertions, Piaget's theory of history well may be a series of logical truths dressed up as empirical facts. In particular, the claim that new theories are created by turning the theoretical terms at one stage into observational elements at the next level is of such generality that it seems to have little relevance to the scientist. Indeed, I would wager that few of the important authors in the history of these concepts would endorse Piaget's characterization of their work as completing the process of reflective abstraction. Of course Piaget's logic of organization does not concern the intentions and interests of particular thinkers, but rather the conceptual relations captured in the abstract structures of the epistemic subject. It is thus an attempt to explain the development of knowledge through a purely cognitive assessment of ideas. Yet as Foucault's analysis of history shows, there are no theory-neutral concepts and no independent norms of development. All judgments must be made from a particular epistemic perspective, and it simply is not possible to factor internal reasons from external causes as Piaget (1971) suggests.

> To say history is not to be deduced does not mean that it cannot be reduced to logical terms after the event, and there are grounds for hope that this sui generis character of historical development may translate itself into a kind of logic, a specific one at that, which would be dialectical. It is true, of course, that so far no one has succeeded in formalizing the dialectical logic, so that such a concept is still open to discussion. But that is not reason for abandoning the project. (p. 340)

It is this 19th century quest for a logic of development, presented in the 20th century terminology of systems theory and cybernetics, that supports Piaget's efforts to provide a conceptual reconstruction of history. But, as the recent debate within the philosophy of science on the paradigmatic structure of inquiry demonstrates, it is not possible to define a logical hierarchy of concepts independently of the scientist's epistemic perspective (e.g., Kuhn, 1965). What counts as progress depends upon the standpoint of history, and as Foucault's analysis shows, competing theoretical orientations yield different chronicles of thought. In short, the logical order that Piaget finds in the history of ideas is in part a projection of his own current views on the nature of knowledge.

My second and more fundamental criticism of genetic epistemology lies with Piaget's implicit equation of knowledge with cognitive structure. Like Kant, Piaget views science and mathematics as products of the individual mind and so reduces knowledge to the operation of universal and abstract categories. Ultimately, Piaget seeks to incorporate concepts from all areas into systems of transformation that represent the mental operations of the epistemic subject, thus producing an abstract competence model of the developing human intellect. Yet, even if it is appropriate to represent knowledge as a form of structure, this does not imply--as Piaget suggests--that such transformations are psychologically real. Social and epistemic organizations may well be of a different order from the type of intellectual coordinations that Piaget describes, and the attempt to conflate the two--like Chomsky's equation of the child with the linguist--only serves to further misrepresent knowledge as the product of a single mind.

Piaget equates knowledge with structure to frame a theory of development in which truth and objectivity can be defined in terms of adaptation. Yet, as Popper's (1979) evolutionary epistemology demonstrates, this approach to the problem of knowledge need not be phrased in terms of the socially impoverished concept of the epistemic subject. For while Popper (1979) agrees with Piaget that "from the amoeba to Einstein, the growth of knowledge is always the same," (p. 261) he rejects any attempt to ground ideas in the development of cognitive structures. Although theories are creatively invented by particular individuals, he argues that once conceived they acquire an independent existence as symbols in the abstract domain of world 3 ideas. According to Popper (1979), then, the development of knowledge, like the development of species, is a process of error elimination, as the insights and intuitions of scientists are appraised through the same post hoc procedures that select randomly mutated genes. Of course Popper does not believe that thought is irrational in the same way that mutations are random, but he avoids Lamarckianism by maintaining that the history of science yields no logic of discovery. The researcher on this account is like a blind person, imaginatively groping for the truth on the basis of a current limited awareness. In short, for Popper (1979) the rational part of science does not lie in the formation of hypotheses, as it does for Piaget, but in the testing and evaluation of ideas.

My final criticism is thus to reject Piaget's Kantian union of knowledge with cognitive structure. Both Foucault (1966) and Popper (1979)--despite their opposing views of history--agree that ideas and concepts must be interpreted in terms of the public conventions and standards implicit in the various traditions of inquiry. Knowledge for these authors is not the product of a structuring intellect but an autonomous feature of language that shapes both our material and all cultural existence. As I have argued, Piaget's history of science as the development of the epistemic subject lacks the force of such socially grounded accounts.

If there is one area that Piaget's internal theory of knowledge must explain satisfactorily it is surely the origin of mathematics, which he characterizes as the domain of pure structure. To repeat Piaget's (1971) explanation, mathematicians produce new structures through the process of reflective abstraction, the reconstruction at a higher level of the physical operations performed in the world. Yet, again, as Rotman (1977), a mathematician, observes,

> most mathematicians would find the programmatic generality of this description oddly tangential to the way they might characterize their subject. For although it is easy to agree that new observation, purification, and consequent abstraction, is a recurrent pattern of mathematical thought, it is hard to imagine how it could account for the whole, or even a large part, of mathematics. Certainly those areas where the structure being studied--like that of the whole numbers or the linear continuum--is fixed in advance seem to be particularly recalcitrant to a description in terms of reflective abstraction. Unfortunately Piaget is so general in his descriptions and restrictive in his examples that a feeling of oddity is not dispelled by examining the cases he cites. (p. 132)

As Rotman continues, the fundamental feature of mathematical inquiry is a concern with proof and the justification of assertions constructed within linguistically defined systems of rules. Even the Bourbaki, who seek an overarching axiomization of the various branches of mathematics, express no interest in its historical origin. Their theoretical reconstruction--influenced by the structuralist movement in France--is motivated by a philosophical commitment to the systemtazation of knowledge in terms of three basic logical structures which, it must be stressed, have no epistemic or cognitive priority. Once again, as Rotman (1977) summarizes, Piaget's Kantian subjectivism seriously misrepresents the socio-historical, linguistic, and publicly objective character of mathematical knowledge, as it does the development of mind in general.

> Judged then as an attempt to give a naturalistic theory of mind, or at least an evolutionary account of its rational component, Piaget's theory has serious shortcomings. It is flawed as we have argued at precisely the point where the organism and the individual as a member of the social community have to be brought into contact. Piaget's paradigm of the individual is the isolated organism adaptively responding to its environment; his paradigm of structure is physiological self-regulation, and his paradigm of the world is the physical environment--the ensemble of relations between objects and physical processes in space-time that can impinge on the individual. The principle failure of this organism/environment model is its refusal to accept the importance of the fact that individuals are immersed in a non-natural world, in an "environment" of ideas, meanings, intentions, history, symbols, within a matrix of social influence and cooperation. Piaget's concentration on the self as an object among objects leads him to hypostasise this environment. He converts relations between viewpoints--how for instance individuals come to change and form their ideas of the world in the face of the other--into relations between activity patterns. Thus when he identifies social cooperation with the coordination of inter-subjective viewpoints, and then subsumes both under the coordination of intra-subjective viewpoints whose laws are those of the amalgamation of structure, he neglects the fact that viewpoints are within language and that language is a social relation that constructs an individual's categorisation of the world. (p. 181)

In Chapter 2 I described how epistemologists from Descartes to Kant attempted to explain the possibility of knowledge through the experiences and innate faculties of individual subjects. Both empiricists and rationalists agreed that knowledge was produced by particular men and women, their dispute focused on the relative importance of mental structures and experience in the learning process. It was Hegel who first rejected this subjective viewpoint and demonstrated that the mind is socially constructed. In place of Kant's innate categories Hegel showed that concepts and meaning are cultural products that develop purposively through history. Like Piaget, Hegel maintained that individuality is not the first intuition of thought that Kant and Descartes believed it to be, but is a concept that like all others is formed through participation in a community.

For both Hegel and Piaget the construction of the subject has moral as well as epistemological significance. Indeed, Hegel rejected all ethical and political theories that sought the foundation of social laws and principles of conduct in the autonomous will of individuals. In their place, as in epistemology, Hegel advocates a view of action that is rooted in the emerging forms of culture. Just as individualism leads to skepticism in questions of knowledge, so it abstracts and fragments people from the community. Only by strengthening the social bonds that integrate individuals within this whole can the purpose and value of life be realized. The young Piaget also endorsed the primacy of the community in his moral and religious writings, rejecting Kant's transcendental arguments for a scientific axiology founded on social experience. It was the most coherent and adapted form of cultural order, rather than the dictates of political authority and church dogma that would fund the good and rational life. For both Hegel and Piaget, values cannot be deduced from a set of rational principles, but must be derived from the logic and circumstance of human experience.

I have argued that Piaget's genetic epistemology has many interesting parallels to Hegel's philosophy of spirit. Both reject the postulation of fixed a priori categories and provide a dialectical deduction of mind based upon the logic of experience. Both view knowledge as a process and invoke the biological model of an organism to explain the telonomic development of reason toward truth. Thought is decentered from its egocentric realism to an objective and relativistic conception of the world, able to comprehend all viewpoints. And one-sided epistemologies, stressing either the subject or the object are overcome through an evolutionary account of knowledge that leads to a quasi-religious, immanent understanding of mind within experience. Yet, as I have argued throughout this chapter, Hegel and Piaget disagree on the role of the individual within this constructive process. Piaget's immense catalog of development, from basic biological organisms to mathematical knowledge, is based upon the organizational logic of a single organism's experiences in an objective physical world. His epistemological reconstruction of this process through the competence model of the epistemic subject is therefore little more than a developmental statement of Kant's structured mind thesis. This vision of a solitary intellect misrepresents the nature of psychological and epistemological process as seriously as Piaget's adaptive logic of the individual organism misrepresents the evolutionary process. For just as biological growth must be understood in terms of the population, so intellectual and epistemic development are inextricably linked to the social and linguistic forms of life that evolve in the historical progress of a culture.

Throughout this dissertation I have questioned structuralism's claim to be a science of the mind on the grounds that it fails to explain the intentional and purposive character of thought and action. Human behavior cannot be reduced to the causal interplay of mental states because intellectual processes depend both on the physical world in which we live and the socio-historical tradition--encapsulated in language--through which we experience it. Piaget attempted to avoid the nativism of the structured mind thesis by proposing a model of learning in which the desires and needs of the subject are fused with the objective properties of reality in a developmental logic of action (from sensorimotor to formal operations). Yet Piaget, like Chomsky, commits the fundamental error of cognitivism by placing the structures of thought within the individual. However, in contrast to Chomsky's nativist arguments, Piaget's constructivism demonstrates that knowledge is a creative product of human labor rather than the unfolding of a fixed intellect. Accordingly, if Piaget's focus on the epistemic subject can be broadened to the role of the individual in the social construction of experience, then the development of the mind can be seen more properly as an initiation into the culturally and historically formed modes of expression that constitute the life of a community.

None of my criticisms are meant to undermine the biological complexity of the mind or reject the need for a scientific study of human nature. As Piaget observed, we all are born with a rich innate endowment, and there clearly is much to be learned about our perceptual organs and the neurophysical structure of the brain that will have direct import for our understanding of thought, feeling, and conduct. But while necessary, such studies do not provide a sufficient or meaningful explanation of human behavior. A person's actions cannot be described satisfactorily through a physicalist account of mental states, since--as I have argued throughout this work--they also must be judged in terms of social rules and historical conventions. Such explanations through reasons rather than causes resist the reductionist ambitions of methodological individualism and firmly establish the role of cultural achievements in the development of the subject's mind.

In contrast to the structured mind theory and the specific heredity implied by the modularity thesis, I have favored Piaget's notion of a general intelligence. Such a learning mechanism, once emancipated from the solitary constructivism of the epistemic subject, offers a more plausible view of biological endowment and socialization than does Chomsky's union of evolutionary design and cognitive growth. While such a conclusion may introduce an indiscernible mix of nature and culture into the description of human actions that will frustrate all efforts to form a science of the mind, it does offer an important and positive manifesto for educators. On this account education is not the task of triggering some inner mental structure that Chomsky and Lévi-Strauss take it to be, but is the construction of the mind through the initiation of children into the public concepts and forms of experience that constitute the historically produced world in which we live.

In sum, whether or not one accepts an "evolutionized" account of knowledge, like Popper's elimination of error through the weeding out of the weakest theory or Hegel's view of learning through experience, is less important than the central conclusion of this chapter, that mind is a social achievement. Human understanding cannot be explained by the cognitive structures of an individual intellect but develops through the public traditions of inquiry that continually reconstruct and requalify our experience in more adequate ways. I will leave the final statement of this position to Popper's one-time student, Richard Peters (1973), and turn in Chapter 6 to the theory of education that this view supports.

> No man is born with a mind; for the development of mind marks a series of individual and racial achievements. A child is born with an awareness not as yet differentiated into belief, wants, and feelings. All such specific modes of consciousness, which are internally related to types of object in a public world, develop later pari passu, with the pointing out of paradigm objects. Gradually the child comes to want things which there are means of obtaining instead of threshing round beset by unruly and unrealistic wishes; he comes to fear things that may hurt him, and to believe that things will come to pass which have come to pass. He learns to name objects, to locate his experience

in a spatio-temporal framework, and to impose causal and means-to-an-end categories to make sense of events and actions. He creates pools of predictability by making promises and stating his intention. In the beginning it was not at all like this. Such an embryonic mind is the product of initiation into public traditions enshrined in a public language, which it took our remote ancestors centuries to develop.

With the mastery of basic skills the door is opened to a vaster and more variegated inheritance. Further differentiation develops as the child becomes initiated more deeply into distinctive forms of knowledge such as science, history, mathematics, religious and aesthetic appreciation, and into the practical types of knowledge involved in moral, prudential, and technical forms of thought and action. Such differentiations are alien to the mind of a child and primitive man--indeed to that of a pre-seventeenth-century man. To have a mind is not to enjoy a private picture-show or to exercise some inner diaphanous organ; it is to have an awareness differentiated in accordance with the canons implicit in all these inherited traditions. "Education" marks out the processes by means of which the individual is initiated into them. (pp. 98-99)

CHAPTER 6
EDUCATION AND THE NATURE OF MIND

Introduction

In this final chapter I return to the educational concerns that motivated the arguments of this dissertation. Following Dewey's (1938) logic of inquiry, the conclusions drawn from my analysis are used to address the questions about intellectual development raised in the introduction to this study. In particular, I demonstrate that in contrast to the structured mind view, the arguments I have advanced justify a theory of mind, knowledge, and value that support an interdisciplinary approach to the problems of pedagogy, a union that fuses theory with practice and establishes the relevance of educational studies for the teacher.

My arguments are divided into five sections. First I discuss the role of reasons and causes in the explanation of human action in order to assess the plausibility of cognitivism as a science of the mind. Rejecting this ambitious program, I offer a more modest task for psychology and explore the implications of this position for educational studies. Second, the relationship between theories of human nature and educational research is examined. I argue that inquiry starts from an overarching view of the subject that determines a specific approach to the epistemological, ethical, and psychological issues facing education. This relationship is explored in the third section, where I discuss the pedagogy of the structured mind thesis. Rejecting this biologically-based model of intellectual growth, I turn in the next section to the work of Hirst and Peters (1971). After tracing their efforts to justify a liberal education through the analysis of concepts such as knowledge and rationality, I show that the pedagogy of the constructive mind cannot be derived from such epistemological considerations but must be grounded in the social organization of a culture. As Dewey (1916, p. 81) observes in opposition to advocates of a liberal education, schooling cannot be justified for its own sake, but must be valued according to the quality of life it promotes. Finally, in the concluding section I offer some suggestions for curriculum planning based upon the pedagogy I have outlined and briefly summarize the main arguments of this chapter and the study in general.

Reasons and Causes in Psychological Explanations

According to Richard Rorty (1979), Descartes's invention of the cogito--the notion of an inner eye presiding over a private realm of ideas--has led epistemology on a 300-year wild goose chase for a non-existent entity, the human mind. For Rorty and other "eliminativists," mental states are fictions generated by a vocabulary that supports the misguided enterprise of justifying knowledge as a correspondence between such representations and an independent external reality. Like the belief in God, Rorty (1979) thinks that the dogma of mind has frustrated scientific inquiry by suggesting the existence of a privileged domain of meaning inaccessible to material explanation. Accordingly, he argues that it now is time to reject this historical myth, the "idea idea" (pp. 131-164), in favor of a neurological study of the brain that matches our physical description of the world.

Such an influential and increasingly popular attack on the possibility of an intentional psychology strikes at the very core of the commonsense view of mind by denying what the layperson tacitly accepts, the causal efficacy of mental states. Our everyday experiences seem to confirm the inescapable truth of folk psychology, that human behavior is determined by the subject's beliefs, desires, and knowledge--that is, reasons are the cause of a person's actions. Insofar as cognitivism is committed to this level of explanation, it must be viewed as a naturalistic successor to the ideational epistemologies of the 17th and 18th centuries. For in their acceptance of the representational theory of mind, cognitive scientists share the conviction of thinkers like Descartes, Locke, Hume, Leibniz, and Kant that human conduct can be understood only through the postulation of mental structures. Moreover, as the political and ethical writings of Lévi-Strauss and Chomsky demonstrate, this view of the person stands in contrast to the passive and malleable subject of the behaviorist tradition. Far from dehumanizing the human agent, the computational model of thought--through its emphasis on complex inner mechanisms--actually reintroduces the enlightenment conception of human beings as creative and autonomous agents. As Chomsky (1988b) argues, the rich innate organization of the mind provides the justification for individual rights, independent thought, and the democratic participation in a community free from coercion and authoritarian control.

Cognitivism thus stands in contrast to Rorty's argument as a contemporary attempt to fuse the traditional concerns of epistemology with the methods of scientific inquiry. As such it also provides both a psychology and an axiology that fund new approaches to questions spanning the spectrum of educational concerns. However, before this model of the subject is admitted into educational theory with the same uncritical attitude that embraced behaviorism, the computational metaphor must be scrutinized for its appropriateness in characterizing human thought. As I have argued throughout this dissertation, the fact that mental abilities can be modelled by systems of rules and representations--derived through the transcendental logic of structuralist inference--does not imply that such "scientific" investigations capture the psychological reality of the mind. Indeed, as my criticisms of Lévi-Strauss, Chomsky, and Piaget demonstrate, such syntactic replications of the intellect fail to duplicate the intentional, social, and historically grounded character of experience. Yet, while endorsing Decartes's (1641/1911) intuition that human behavior cannot be reduced to a governing grammar of rules, the reader should recognize the promise of cognitivism as a scientific account of action based on a causal economy of intentional states. In this union of reasons and causes, cognitivism, despite its limitations, presents a powerful argument for capturing the mind within the laws of physics.

In Chapter 1 I explained how the opening gambit of materialist philosophers was to deny the reality of private experiences by defining mental states in terms of behavioral dispositions. This rejection of inner subjective events was followed by a series of identity theories that equated mental terms with brain states. While a strict reduction of mental kinds to physical kinds proved unworkable, the stage was set for token physicalism and the functionalist theory of mind. Invoking the metaphor of the computer, Putnam (1975) argues that brain states support mental states in the same manner that a machine language supports software programs. On this account, the causal role of a mental type is to be understood through its functional relations with other mental states and the input stimuli of the subject's perceptual mechanisms.

By defining intellectual processes independent of their material host, functionalism has become the adopted theory of the cognitive sciences. Equating the brain with a Turing machine, artificial intelligence (AI) researchers attempt to explain the mind through computer programs that model human abilities. Indeed, in its strong version AI puts forth the claim that the mind is a computer program and that, given the appropriate algorithm, a machine will think as humans think.

The most obvious objection to such a view is that the content-free manipulation of symbols cannot yield the intentional character of experience; that is, semantic properties cannot be constructed from syntactic rules. Fodor's (1975) solution to this problem is to maintain that the mind works through syntax but that the machine code (in which we think) has innately defined semantic properties. Accordingly, learning the terms of a natural language (through which we communicate) is a process of hypothesis testing in which the predicates of "mentalese" are used to construct the meanings of words.

If such a radical nativism is the logical consequence of cognitivism, as Fodor (1975) suggests, then surely there must be something fundamentally inappropriate in comparing the mind with a computer. For despite a number of basic similarities--both the mind and the computer manipulate abstract symbols--there clearly are many differences in their respective abilities. In fact, computers often appear more "intelligent" than humans in manipulating numbers and symbols without error at speeds thousands of times faster than the most able mathematicians can accomplish. In contrast, humans with their "torturously slow" neural architecture are capable of semantic associations that, according to Dreyfus (1979), in principle are beyond any possible program, irrespective of its size or complexity. Moreover, as Searle (1980) argues, computers and brains have very different causal properties, a criticism that for many underlies the impossible task that AI faces in its attempts to explain the problems of intentionality and qualia.

Reflecting on such limitations, future historians may wonder why the digital computer offered such promise as a model of the mind. In part, as Gardner (1987) chronicles, the answer must acknowledge a remarkable convergence of inquiries--within a variety of disciplines--that suggested that human thought could be duplicated by electronic devices. In logic, both the work of Alan Turing and the propositional calculus of Russell, Whitehead, and Wittgenstein demonstrated that thought could be broken down into rule-governed transformations of basic symbols. Shannon demonstrated that such procedures could be constructed with electronic circuits. Winer explained how mechanisms and cybernetic structures can exhibit purposes and intentions. And McColloch and Pitts argued that communication among networks of neurons can be simulated by binary operations. In short, the scientific knowledge of the 1950s supported the inference that the brain was in fact a Turing machine.

Although this technical synthesis provided the logical apparatus for explaining the manipulation of mental representations, it took the pioneering work of structuralist thinkers like Lévi-Strauss, Piaget, and Chomsky to demonstrate the necessity of such mechanisms for the analysis of human action. Cognitivism was thus born from the union of these complementary studies, fusing a theoretical account of brain functions with a practical and commonsense view of the mind through the model of the computer.

It may be that the rules and representations version of cognitivism is intellectually spent, and perhaps--as Rorty (1979) predicts--causal explanations of behavior must be sought at the level of the neuron. Yet such a conclusion, while endorsed by modern connectionist theories (Campbell, 1989), entails the unpalatable consequence that intentional states do not direct behavior. This conclusion, forcefully advocated by Churchland (1988), rejects attempts to explain a person's actions in terms of beliefs and desires as an historical myth. At best, Churchland argues, folk psychology is a primitive theory--entrenched in our language and culture--which while bringing some predictive power to experience is nonetheless seriously limited in its characterization of the human mind. For Churchland, the complex workings of the brain cannot be modelled by such "ficticious" mental states, but demand careful exploration through the mature techniques of neuroscience. However, before donning their white coats for a second time, psychologists ought to reflect carefully on just how central this concept of human nature is to our daily lives. From the earliest stages of socialization to a dying person's last will, in our educational, legal, and political endeavors, in fact in all discourse and interaction, the underlying assumption is that people act according to reasons. Indeed, as Peters (1974) recognizes, we only look for causal explanations of behavior (e.g., brain defects, personality disorders) when reasons fail us. So, while dismissing the implicit biologism and "methodological individualism" of cognitivism, it is important to recognize the efforts of philosophers like Fodor to justify the truth of folk psychology within the materialist program. Human actions must be understood in terms of reasons, even if this turns out to be incompatable with the unity of the sciences program.

In Chapter 1, I described how both Peters and Davidson rejected the possibility of establishing psycho-physical laws. For these writers and other socially minded critics, behavior can be understood only when it is set in the context of the linguistic rules and public conventions that form the holistic fabric of our culturally defined lives. On this view the cognitive enterprise--in its efforts to reduce semantics to syntax--is fundamentally misconceived, since meaning, the intractable element of human experience, cannot be captured by nomological rules. Yet many influencial American philosophers (e.g., Churchland (1988), Rorty (1979), and Stitch (1983)) reject this conclusion in favor of Quine's (1983) naturalistic stance and the belief that all phenomena, including the mind, can be analyzed through the laws of physics. As Rorty (1979) argues,

> every speech, thought, theory, poem, composition, and philosophy will turn out to be completely predictable in purely naturalistic terms. Some atoms and the void account of microprocesses within individual human beings will permit the prediction of every sound or inscription which will ever be uttered. (p. 387)

Clearly, the human organism has many highly complex physical features that directly influence behavior. The organization of the genetic code, the structure of perceptual mechanisms, and the intricate neurophysiological components of the brain all are in part causes of a person's actions that may be studied scientifically. Further, it also seems appropriate to investigate the underlying cognitive processes and potentialities that in the course of experience develop into the infinite range of human capacities. However, such inquiries cannot, even in principle, explain every dimension of cognitive life.

In particular, the intentional character of thought and action is beyond physicalist description, not because of any ontic dualism between mind and matter, but because meaning is an emergent property acquired in the process of socialization.

A fundamental fact of development is that the human phenotype emerges from a chaotic mixture of nature and culture. Not only are the social components of growth indeterminate, but their role in the epigenetic construction of mature neurological mechanisms is also unpredictable. Once the complexity of this system is recognized, then, as Manicas (1987) argues,

> the limits of a scientific psychology can be seen more clearly. As humans, we are interested in explanations of why particular people have the particular traits, competences, personalities, attitudes, beliefs, and disabilities which they have. If the foregoing is correct, however, we should not expect a Copernican Revolution in our ability to provide answers to these questions. No two human genotypes are the same, a fact of considerable relevance to the problem. From the moment of conception, the developmental process is epigenetic. Well before the fetus emerges into a social world, the latitude for epigenetic vagaries is immense. After that, everything that happens is an indiscriminable mix of nature and nurture, biology and cultue. When, then, our concern is the distinctly psychological--the personality, competences and disabilities, beliefs, attitudes, styles, and dispositions--isolating the pertinent causal factors which make for our fantastic human diversity will be profoundly difficult. As William James rightly observed, human individuality is obscure, ultimately inexplicable. (p. 304)

Yet such a conclusion does not imply that psychology must abandon its scientific goals and adopt Winch's (1958) approach to the analysis of behavior. It merely makes cautious the aspirations of those who seek a unified theory of human nature modelled on the explanatory power of the physical sciences. During the 1950s the majority of Anglo Saxon psychologists rejected the intentional vocabulary of folk psychology for the promise of a science of behavior based upon the observable actions of human and animal subjects. On the assumption that a person's reasons, desires, and beliefs can be ignored in any explanation of their behavior, researchers confidently applied the results of their laboratory experiments to a range of social concerns. In particular the work of theorists like Thorndike and Skinner provided the basis upon which extensive implications were drawn for the organization of schools and the structuring of learning activities (Farnham-Diggory, 1990). Yet, as Peters (1975) laments, such theoretically generated inquiries, when conducted under the patronage of educational studies, often result in abstract and inert thought detached from the concrete problems of the teacher.

> In recent years I have moved over into the applied field of the philosophy of education. One of the things that has depressed me most has been the dearth of limited generalizations established by psychologists in the field of learning, academic motivation, and classroom control. And one of the inhibiting factors has surely been the yearning for scientific respectability of psychologists working in this field, which they have imbibed from departments of pure psychology. Instead of setting out concretely what needs to be known and trying to devise ways of decreasing our ignorance at the coal face, as it were, they have tried to apply some piece of one of the classical theories in this field and have consequently bored generations of teachers to death with these irrelevant pieties. (p.58)

According to Peters, educationalists must not follow the theoretical speculations of their parent disciplines, but should construct their own modest and piecemeal inquiries into the practical concerns of pedagogy. While this may involve adopting a less rigorous conception of the scientific method, perhaps replacing physics with a more general inquiry like botany or geology as the paradigm for explanation, the results of such studies arguably will be of greater practical import for the teacher. The point may be expressed in the following way. Artificial intelligence attempts to explain human action in physical terms necessarily factor out the very components that make a person's behavior meaningful, but a simple event, drinking a glass of wine for example, cannot be described unless its purpose also is appreciated. For a person involved in a religious ceremony, this act, while ostensibly equivalent to the behavior of another, may have a very different significance. And this meaning, as I have argued in my criticisms of cognitivism and structuralism, can be understood only in terms of the social and linguistic conventions that govern a person's life. Reasons cannot be replaced or captured by an explanation in terms of causes, and it is upon this realization that the unity of the sciences program must ultimately flounder.

Again, my criticisms are not meant to deny the need for psychological inquiries into human behavior, but rather to set the context for such studies and indicate the limits of scientific explanation. Such considerations are expecially pertinent in the field of education, where unlike many areas of psychological interest, the concern is not with abnormal subjects (where behavior might be caused by some physical defect) but with children whose actions are so clearly dominated by beliefs, purposes, and desires.

Theory and Practice

In Chapter 1 I discussed some of the problems generated by the fragmentation of inquiry within educational studies. Following Peters (1966), I argued that many students find theory to be so divorced from the concerns of the teacher that it is of little or no value in directing judgment. This apparent lack of relevance is also enhanced by the academic drive for professional respectability that leads many educational researchers to focus on the problems and methodology of their discipline rather than concrete questions from the classroom. If theory is to be of value to prospective teachers, inquiry must recognize both the interdisciplinary character of educational issues and the practical context in which they originate. Failure to meet these basic conditions of thought will only solidify the conviction of many that educational studies are both abstract and self-serving. According to Dearden (1984), it is this popular opinion, combined with the economic axe of the Thatcher regime, that has resulted in the systematic dismantling of education departments throughout the British university system.

I also argued in Chapter 1 that a central concern of education is the nature and development of the mind. Although this topic is often discussed by exploring the ideas of Piaget, Lévi-Strauss, and Chomsky, the same fracturing of inquiry that I have criticized can lead to a basic misrepresentation of their work. Thus, the first task of this dissertation was to identify the similarities and differences in the respective projects undertaken by these three thinkers. To that end, I introduced two contrasting theories of human nature that originate respectively in the philosophies of Kant and Hegel. I argued that Chomsky and Lévi-Strauss endorse a modern "biologized" statement of Kant's structured mind thesis by asserting that the brain is prefigured with a number of species-specific intellectual capacities. This "new rationalism" thus supports a contemporary advocacy of the "romantic" conception of education as the nurtured unfolding of inner potentialities (Kohlberg, 1986). In contrast, Piaget rejects such nativist conclusions and endorses the model of the constructive mind to explain--as Hegel did--the rational development of reason through the dialectic of experience.

The second, and more critical, project of this study was to evaluate the plausibility of these two viewpoints. Although accepting the historical component in Piaget's account, I argued that like

Lévi-Strauss and Chomsky, his theory is both socially impoverished and theoretically underdetermined. Indeed structuralism, like its modern successor, cognitivism, is committed to a computational model of mind that is not only biologically implausible but also is incapable of explaining the intentional character of experience. As Peters (1958) taught, human conduct can be understood only in terms of the governing grammar of customs and practices that define the life of a culture. I concluded my criticisms by favoring a socialized interpretation of Piaget's thesis, in which the subject's developing cognitive abilities are achieved through general learning mechanisms and the process of socialization. On this reading, education is the construction of mind through the initiation of children into the publically and historically evolving modes of experience.

Having completed this analysis, I now will return to the context in which the problem of this dissertation was initially phrased. How can the theories of mind that have been discussed direct educational inquiry and inform pedagogy? However, it should be recognized from the outset that the arguments I have been considering do not by themselves fund specific classroom activities. Neither the theory of the structured mind nor the thesis of the constructive mind supply ready answers to the practical concerns of the teacher. Yet each of these orientations, with their particular leanings toward either nature or culture, do suggest radically different approaches to the process of learning and the function of education as a social enterprise. Accordingly, the conclusions I will draw from this study will focus upon the general issue of the teacher-student relationship that each of these viewpoints supports.

By fusing a theory of mind with a complementary axiology, each approach establishes a distinctive model of human nature that suggests far reaching implications for the structure and purpose of education. On one hand, Chomsky's (1988b) campaign against society's corruption of the individual and his attempts to replace current theories of learning with a concept of development based upon the maturation of innate intellectual capacities, implies a "negative" role for the teacher as the protector of the child's inner potential and natural goodness. Invoking familiar metaphors, Chomsky (1988a) explains how the teacher might best facilitate the development of the subject's cognitive abilities.

> Such organs can flourish or be restricted and suppressed, depending upon the conditions provided for their growth. Teaching should not be compared to filling a

> bottle but rather helping a flower grow in its own way. Reason, the ability to make use of one's powers freely and usefully, and other human qualities can be achieved only in an environment in which they can flourish. They cannot be taught by coercive means. What is true of physical growth holds quite generally of human maturation and learning. (pp.135-136)

In contrast to this biological model, Peters views education as a socially interactive process in which children are inducted into the language, concepts, rules, and standards of the various public traditions of inquiry. It is by internalizing these culturally defined forms of thought and feeling that the individual is able to acquire what Peters regards as the historical achievements of reason and value that support the rational life of the democrat. Accordingly, on Peters's account the teacher has the positive role of leading students into increasingly more sophisticated conceptual schemes, that is, constructing the child's mind through the progressive requalification of experience.

Both the theory of the structured mind and the thesis of the constructive mind establish distinctive psychological and ethical views of the subject that support radically different approaches to pedagogy. The former model endorses the "romantic" conception of the child traditionally associated with the writings of Rousseau and Pestalozzi (Kohlberg, 1986). The latter, with its stress on interaction and the socio-historical origins of mind is closer to John Dewey's philosophy of education. In the following two sections, I will examine the aims and methods of these viewpoints. Once again, my objective is to undermine the individualistic and biological basis of the structured intellect argument in order to support Peters's conviction that education is a constructive process.

Education As Growth

Pestalozzi provides the classic statement of the romantic thesis in a passage that, if exorcised of its religious allusions, could easily have come from the pen of Noam Chomsky. Teaching, Pestalozzi argues,

> is like the art of the gardener under whose care a thousand trees blossom and grow. He contributes nothing to their actual growth: the principle of growth lies in the trees themselves. He plants and waters, but God gives the increase. It is not the gardener who opens the roots of the trees that they may draw food from the earth; it is not he who divides the pith from the wood and the wood from the bark, and thus helps forward the development of the separate parts. . . . Of all this he does nothing; he only waters the dry earth that the roots may not strike it as a stone. He only drains away the standing water that the tree may not suffer. . . .So with the educator: he imparts

> no single power to man. He gives neither life nor breath. He only watches lest any external force should injure or disturb. He takes care that development runs its course in accordance with its own laws. . . . He knows that sound methods of popular education must agree with the eternal laws according to which these powers unfold, and that these methods must be sought in that which strengthens and purifies the moral and religious bonds of our powers. (Cited in Darling, 1982, pp. 173-174)

For the advocate of this romantic ideology, intellectual development, like physical growth, is the unfolding of biologically determined principles. The telos of this process is the harmonious transformation of the genotype into a healthy phenotype that actualizes the child's innate powers. Accordingly, education is the set of activities that nurture this maturation both by protecting the subject and engineering those experiences that facilitate the emergence of its inner potential. It is thus nature rather than culture that provides the guiding ethos of this pedagogy, not only to campaign against the psychological implausibility of traditional theories of learning, but also to demonstrate their implicit immorality. As Chomsky (1988a) argues in his criticisms of empiricism, such practices impose an external--and by implication unhealthy--structure on the mind that suffocates natural tendencies and the inherent goodness of the child.

Theorists favoring the structured mind thus stress the subject's freedom from interference. Evil, Rousseau (1755/1964) argues, does not come from the child, but from a corrupt society. So "the education of the earliest years should be merely negative. It consists not in teaching virtue or truth but in preserving the heart from vice and the spirit from error" (pp. 57-58). Likewise in his efforts to protect the subject from the manipulative force of a domineering culture, Chomsky recognizes the process of schooling to be a tool of economic and political enslavement. (In Chomsky's (1988b) opinion, behaviorists were interested in education not only as a workshop for their learning theories, but also as a foundation for establishing an authoritarian ideology.)

> Schooling. . .is. . .a period of regimentation and control, part of which involves direct indoctrination, providing a system of false beliefs. But more importantly, I think, is the manner and style of preventing and blocking independent and creative thinking and imposing hierarchies and competitiveness and the need to excel, not in the sense of doing as well as you can, but doing better than the next person. (p. 6)

In contrast to this Orwellian picture of social manipulation, Chomsky draws on his early experiences as a student in a Dewey school to demonstrate that education can be based upon the creative interests of the child. For Chomsky, the thesis of the structured mind not only funds a "romantic" education for Rousseau's Émile, but when allied with the cognitive paradigm it provides a sounder practical, ethical, and psychological basis for the organization of schools.

Over the past 20 years an increasing number of researchers have attempted to apply the principles of cognitive psychology to the organization of learning activities. Just as Chomsky rejected behaviorism as a plausible model of human nature and an inappropriate model for the social sciences, so educationalists are now seeking to free pedagogy from its entrenched commitment to this paradigm. As Wood (1988) observes, notable results have been achieved especially in our understanding of specific tasks like the teaching of reading and mathematics. While such advances demonstrate the superiority of cognitivism over the passive view of the subject, for writers like Farnham-Diggory (1990) they represent only the first step in what promises to be a sweeping reorganization at all levels of schooling. Educationalists are now recognizing that the simplistic psychological assumptions underlying behaviorist learning strategies seriously misrepresent the child's innate capacities and often impede intellectual growth.

> Unfortunately, the formal educational system--based as it is on outmoded, incorrect, oversimplified psychological principles--all too often collides catastrophically with children's natural learning skills, teaches them to mistrust and repress those skills, and moves countless numbers of children through 15,000 hours of systematic training in learning not to learn. All this occurs, moreover, while the brain is particularly receptive and adaptive--a special growth period that has taken the human species millions of years to evolve. (Farnham-Diggory, 1990, p. 49)

Indeed, it is quite remarkable how deeply American schooling is committed to the passive mind ideology of the behaviorist tradition. Largely influenced by Thorndike's learning theory and his emphasis on control and measurement, education has evolved into a series of behavioral tasks to be evaluated not by what students learn, but by their responses on multiple choice tests. As Farnham-Diggory (1990) observes, this profoundly misleading psychology with its

> emphasis on quantitative measurement today characterizes almost every aspect of educational planning, performance, and evaluation. Legislators and state school boards

> explain allocations and policies in terms of scores on competency tests or time spent on particular subjects. Commercial test and textbook publishers generate billion dollar businesses accordingly. Children's progress is precisely charted in terms of right answers and pages covered. Contemporary education is still largely driven by psychological principles similar to those Thorndike originated in his doctoral thesis over a century ago.
>
> Thus, the schoolchild of the late 20th century is but a very small cog in an enormously complex educational machine that continues to justify itself in terms of early 20th century theoretical concepts. (p. 28)

Thus, in addition to the ethical arguments usually cited in favor of the romantic ideology (Kohlberg, 1986), contemporary advocates of this pedagogy also point to the rise of cognitivism and the belief that intellectual development is determined by the complex mechanisms of the structured mind. As psychologists turn their attention from questions about the control and measurement of behavior to the modelling of mental capacities, so it is argued that pedagogy should follow suit and organize schools around children's natural abilities rather than learning principles based upon the observation of cats and chickens (Robinson, 1986).

For the teacher the education as growth metaphor undercuts current efforts to define development in terms of behavioral changes. Rather than structuring a learning situation externally around the component skills of some desired ability--identified through the procedures of task analysis--this model suggests that educators rely upon the natural, biologically evolved strategies of the brain. As experience shows, the human mind is a complex mechanism that can accommodate to situationally defined tasks without having to first acquire a series of subskills. The thesis of the structured mind demonstrates that

> we can and do learn to identify important goals, cues and strategies. It's not necessary for schools to chop learning experiences into small parcels to be practiced over brief intervals. We know that minds learn by constructing elaborate working-memory programs for dealing with important events over long time periods. Formal education should begin, then, with the student's entry into complex, long-range learning situations that genuinely matter. (Farnham-Diggory, 1990, p. 57)

Pursuing these insights, Collins, Brown, and Newman (1989) suggest that schools should be organized around schemes of cognitive apprenticeships in which children learn important skills and knowledge directly from the example of experts and their participation in significant tasks. Like Dewey's notion of occupational learning (Farnham-Diggory, 1990), students approach problems not through the abstract step-by-step procedures of formal teaching, but by coming to think, reason, and value things the way their instructors do.

By relying on the child's natural learning abilities, the teacher thus can focus on the important task of presenting information and important skills in a manner that will stimulate the student's natural curiosity. As the growth metaphor suggests, the teacher's role is to nurture an environment that will allow the subject to follow inner creative impulses and innate learning strategies. As Chomsky (1988b) comments,

> my own feeling, for what its worth, is that at any level, from the nursery to graduate school, teaching is largely a matter of encouraging natural development. The best "method" of teaching is to make it clear that the subject is worth learning, and to allow the child's--or adult's--natural curiosity and interest in truth and understanding to mature and develop. That is about 90% of the problem, if not more. Methods of instruction may influence the residue. (p. 502)

In sum, the model of the structured mind asserts that the teacher's prime duty, like that of the gardener, is to protect and nourish. Free from external control and obstacles to development, the child can grow both morally and intellectually to its fullest potential. Education is no more a process of imposing values and knowledge on a subject than horticulture is the task of imparting beauty upon flowers. Structure comes from within, not through teaching. Educationalists should be guided by this biological analogy and direct their efforts toward fostering the natural growth of the child's mind.

Throughout this dissertation I have argued that the thesis of the structured mind is biologically implausible, overly individualistic, and theoretically undetermined. Exactly the same criticisms can be levelled against the pedagogy that this viewpoint supports. As Dewey (1916) argues, the education as biological growth metaphor seriously misrepresents the ethical and psychological character of the subject by equating physical structure with knowledge in a sentimental image that both neglects the social component of learning and belittles the child (Kohlberg, 1987).

Although babies do mature into adults with the same biological necessity that leads an acorn to develop into an oak tree, the important question for human beings--not captured in the plant analogy--is what sort of person will the child become? In contrast to flowers, infants are not strictly bounded by the instructions of the genotype, for while human nature is clearly influenced by biological traits, as I argued earlier, it also is determined by learning and experience. Romantic theorists talk of education as a process of actualizing some inner potential. But principles of conduct, values, knowledge, aesthetic awareness, and the myriad characteristics of an educated person are not part of our biological make-up. They are, nonetheless, constitutative of what it is to be a developed human being. The character and abilities of a mature adult are an indiscernable product of natural capacities and cultural experiences. The point is not to reduce an individual to one side of this equation, but to recognize, as Margolis (1984) argues, that human nature is an incarnate, emergent property of this probabilistic and chaotic union.

The standards by which we judge a person's growth do not refer simply to the physical structure of their brain, but also the manner in which they participate in the community. Unlike plants, children develop within a social milieu, and it is precisely this context of life that provides the criteria of success and failure that determine the proper course of their education. Indeed, it is telling that followers of the horticulture metaphor often resort to vague notions of "true growth" to contrast the random development of wild plants with the more pleasing beauty of their domestic counterparts (Peters, 1973). Clearly, the truth is that even the gardener shapes and prunes, breeds, and cross-fertilizes in order to manipulate nature for human ends. In short, normative judgments about the direction of growth cannot be derived--even in principle--solely from a knowledge of the child's inner potential, but involve values that are implicitly defined within the life of a culture.

If human beings are not determined from within, as the thesis of the structured mind implies, but are created, in a fundamental sense, through the requalification of thought with historically evolving categories, education cannot be the negative task of simply protecting the subject and promoting maturation. Rather, it must be recognized as the more positive process of constructing the mind by initiating children into progressively more adequate ways of comprehending the world. As Peters (1974) observes,

> although the physical environment of a plant influences its development, it is in no sense constitutive of it. The plant does not become like the soil or the sun when it

> takes it into its system. In the mental case, on the other hand, much of the content of development is provided by the social environment. Children model themselves on others. Also what we call teaching processes have in common the fact that some sort of content--a belief, a rule, a way of behaving, is displayed, indicated or marked out in some way or other for the learner to make his own. The phrase "make his own" is also significant in the human case. For human beings develop in part because of their decisions and choices. They make themselves to a certain extent. This way of talking is quite inappropriate at the plant or animal level. (p. 504)

The education as growth metaphor often finds sympathetic ears when it espouses the shielding of the subject from the authoritarian control of the state. Yet, although the manipulation of the individual for the ends of others is an emotionally charged issue, especially when written on the innocent face of a child, the individualistic rhetoric of the romantic model also hides a socially divisive principle: the fracturing of a culture through the isolation of its members. By stressing the inner personality, supporters of this viewpoint stress ideals of self-sufficiency and personal control, attitudes that according to Dewey (1916) lead to social division, competitiveness, and a lust for immediate gratification.

Although Chomsky (1988a) and Lévi-Strauss (1949/1969), like other writers in this tradition, follow Rousseau by arguing that children are naturally good, such assumptions are psychologically unfounded. In point of fact, it may be the case that people raised in accord with a thoroughgoing individualistic ideology will become more manipulative and aggressive, possibly viewing social ties as expedients to personal rather than collective ends. In fact, Dewey (1916) argues that approaches to education based upon the belief that children are intrinsically good actually inhibit growth by restricting communication and limiting the possibility of fruitful interaction. "What is called inner is simply that which does not connect with others . . . . What one is as a person is what one is associated with others, in a free give and take of intercourse" (p. 143). So in contrast to the proponents of the structured mind, Dewey sees growth as a social process. Approaching Hegel's bildung metaphor--the purposive development of mind toward truth--Dewey's concept is not one of a physical unfolding but a mode of association that maximizes new opportunities and promotes the reconstruction of experience. As I will argue, for both Dewey and Peters the ideal form of social organization, democracy, is growth writ large.

When the concept of development is emancipated from this biological metaphor, then growth can be viewed as the educative process of socializing the young into the customs and practices of their culture. According to this constructivist pedagogy, the teacher is not external to the learning process, tending to children's needs, but is an active director who creates new interests by initiating students into socially evolved ways of understanding the world. Unlike the gardener, the teacher is not just concerned with the appearance of growth and cannot leave development to the biological fiat of nature.

In sum, I have argued that the education as growth metaphor--like the thesis of the structured mind--presents a biologically inappropriate model of human nature. Its asocial characterization of the subject leads to unfounded psychological theories about the maturation of cognitive abilities as well as contestable assertions of the child's natural goodness. The comparison of education with horticulture, like the equation of mind with physical structure, is profoundly misleading and fails to capture the fact that intellectual development is constituted by the concepts, knowledge, and values that bring order to experience.

In the following section, I will discuss Peter's efforts to formulate a philosophy of education based upon this constructivist insight. In his early writings, Peters (1966) combined the philosophies of Wittgenstein (1958) and Popper (1979) with his own ethical and psychological studies to form a powerful picture of human nature and development. He believed that the individual can be led to the historical achievement of the rational life by adopting the standards and principles of thought implicit in the various public traditions of inquiry. By linking mind and knowledge in this manner, Peters sought an intrinsic justification of education--as an end in itself valued for its own sake--through a conceptual analysis of "rationality." While this thesis has proven highly influential, it also has generated a great deal of criticism, not least for its apparent insularity and asocial tenor. In his efforts to address these concerns and accommodate his own reflections on the worth of a liberal education, Peters (1981) came to believe that educational aims must be justified in terms of democratic values. I will explore some of these arguments in order to trace the development of Peters's thought and show how, when socially grounded, the thesis of the constructive mind supports a practical pedagogy and a relevant curriculum.

Education As Initiation

In 1962 Richard Peters was appointed Chair of Philosophy of Education at the University of London Institute of Education. In the 21 years of his tenure, his efforts to rejuvenate educational studies with purpose and relevance effected something of a revolution in British teacher preparation programs, establishing the philosophy of education as an academic discipline and his department as the world's foremost center for its study (Cooper, 1986).

At the time of his inaugural lecture, "Education as Initiation," Peters (1964) surveyed the state of his adopted subject and concluded that despite the insightful ideas of thinkers like Michael Oakeshott and L.A. Reid (his predecessor at the Institute), the philosophy of education had established no clear methodology or agenda of inquiry. Typically studies were conducted under one of three categories: the discussion of teaching principles, debating the ideas of great educators, and tracing the pedagogical implications of the various schools of philosophical thought. In place of this "undifferentiated mush" of armchair musings and personal anecdotes, Peters (1977, p. 140) decided to follow Dewey's example and organize educational studies around the concrete problems of the teacher. Since Peters was committed to the view that the philosophy of education should employ the same rigorous methods as every other branch of philosophical inquiry, he applied the techniques of linguistic analysis to a number of key educational terms. A new and exciting field of study thus emerged around the systematic investigation of concepts like "teaching," "development," and "knowledge," as philosophers learned to apply their analytic methods constructively to important questions of practical concern.

Central to this entire enterprise was the concept of education. Yet as Peters (1973) recognizes, few thinkers have attempted to characterize the activities that make up this basic human endeavor.

> Education has become rather like the Kingdom of Heaven in former times. It is both within us and amongst us, yet it also lies ahead. The elect possess it, and hope to gather in those who are not yet saved. But what on earth it is is seldom made clear. (p. 82)

By mapping the "logical geography" of this concept, Peters sought to provide both a stimulus and an orientation for educational studies, revealing exactly what is involved in the process of schooling the young. With this manifesto and Peters's lecture as the standard of philosophical method, a generation of educationalists pursued the practical and theoretical implications of these insights (Dearden, 1984).

Against the traditional and romantic approaches to pedagogy, Peters (1977) identifies three criteria of education. First was a procedural condition recognizing that the child must participate voluntarily in the act of learning. Education may employ a wide range of techniques, from teaching to punishment, but it cannot involve coercion, conditioning, or the administering of drugs. Second, Peters introduces his theory of value by maintaining that education must bring about worthwhile states of mind: attitudes to knowledge and inquiry in which the subject comes to appreciate standards of truth and justice, not for vocational utility, but for their own intrinsic merit. For Peters (1977), such principles are built into the concept of reason and therefore are presupposed in the pursuit of the rational life. Finally, Peters presents his theory of mind by arguing that education is concerned with the development of "cognitive perspective." Over the years this criterion has proven to be the most influential component of his analysis. In contrast to the conservative model of training and drill, and the romantic metaphor of self-realization, Peters thus argues for the induction of children into the concepts and methods of judgment defined by the historically constructed traditions of inquiry. With this new prospectus, Peters offers a clear and positive directive for curriculum planners: to broaden and deepen the child's understanding of the world through the continuous requalification of thought achieved by an initiation into the public forms of knowledge.

While the various strands in this argument may be laid out and debated separately, taken together they make a forceful case for education as the construction of mind by leading children into the thought and values of the rational life. As Dearden (1984) summarizes,

> Peters argued . . . that "education" is a family of morally legitimate procedures which aim to develop intrinsically worthwhile states of mind with wide-ranging cognitive content. The process as a whole was conceived by Peters as a development of mind through initiation into public traditions which incorporate impersonal standards and which, if mastered, give a distinctive quality to life. (p. 31)

If Peters's missionary-like fervor to spread this view of education brought him many intellectual disciples (Cooper, 1986), his ideas also generated a great deal of controversy. Yet it must be recognized that as the father of this movement, Peters made such a debate possible and, indeed, carefully nurtured it by establishing the first British journal in this area, the Proceedings of the Philosophy of Education Society of Great Britain. As I will show, Peters has refined and amended his arguments considerably in response to these criticisms and his own reflections on the aims of education. His mature position, presented in Democratic Values and Educational Aims (1981), marks a move away from the unpacking of "the rational life" approach to a social conception of education that, in several important respects, converges with the philosophy of John Dewey and the arguments of this dissertation.

In the first wave of criticism, Peters was charged with "intellectualism" and was accused of presenting a narrow and by no means universally accepted view of education (Dearden, 1986). In particular, it was argued that his analysis neglected the social, emotional, and aesthetic dimensions of development in favor of a dressed-up statement of the traditional concept of a liberal education. The target of this critique was Peters's efforts to justify worthwhile activities. Quite rightly, Peters was challenged on his attempt to establish a standard of value through the conceptual analysis of reason (Dearden, 1986). Questions about worthwhile pursuits, as he was later to accept, depend upon the social and ideological determinants of thought, not the intrinsic nature of knowledge (Peters, 1981). In his first formulation of this argument Peters (1966) offered a transcendental justification of educational content. He claimed that if a person seriously asks the question, "Why do x rather than y?," then they are committed to certain forms of inquiry that will provide reasons to support their choice. In fact, he continues, not only are certain pursuits necessary to the resolution of this question, but they actually are presupposed in its presentation.

> For how can a serious practical question be asked unless a man also wants to acquaint himself as well as he can of the situation out of which the question arises and of the facts of various kinds which provide the framework for possible answers? The various theoretical inquiries are explorations of these different facets of his experience. To ask the question "Why do this rather than that?" seriously is therefore, however embryonically, to be committed to those inquiries which are defined by their serious concern with those aspects of reality which give context to the question hs is asking. (p. 164)

The problem with this argument lies in the attempt to justify disciplines such as mathematics and biology as a means of answering this foundational question. What Peters actually sought in his analysis was an intrinsic demonstration that the culturally constructed traditions of inquiry provide a basis for the rational life. Yet such transcendental arguments only separate intellectual pursuits from the social context of experience and present knowledge as a series of abstract games. Academic disciplines, of course, are not self-contained puzzles, but relate to the historical efforts to bring order and meaning to human existence. Consequently, in response to such criticisms, Peters (1977) changed the focus of his argument from the analysis of education to the concept of an educated person. His aim was to support a particular view of the rationally autonomous individual--derived from the 19th century image of a liberal education--in which moral and intellectual development is fused in the building of character. As Peters (1973) explains, education is not simply the transmission of information, but is the process of constructing the autonomous individual by introducing children "into activities, modes of conduct, and thought which have standards written into them by reference to which it is possible to act, think, and feel with varying degrees of skill, reverence, and taste." (p.107)

While many questioned the "overly" cognitive orientation of Peters's first position, the concept of education based upon the telos of an autonomous individual appeared to address more squarely the aesthetic, social, and emotional components of development. Actually, Peters has always opposed the fragmentation of thought into separate dimensions. On the one hand he argues that intellectual judgments incorporate an assessment of values and standards that underlie the rational commitment to truth. On the other hand, he shows that the education of the emotions depends upon distinctively cognitive concerns. It is only by broadening and deepening the understanding of interpersonal relationships, social conduct, and human nature that children can overcome the conceptual difficulties that block rational responses to problematic situations. In short, for Peters (1973), feeling involves cognition, just as cognition involves feeling, and both develop hand in hand when education is seen as the initiation of the mind into the life of reason.

Peters introduced the concept of an educated person as the central aim of education, and his one-time colleague Paul Hirst crafted this goal into its most articulate and influential statement (Dearden, 1984). In Liberal Education and the Nature of Knowledge, Hirst (1974) combines Peters's views on mind and value with a Wittgenstenian analysis of knowledge, language, and thought. Briefly, he argues that only through the employment of public symbols and concepts can human beings understand both themselves and the external world. In contrast to the influential Harvard Report (1946), Hirst (1974) maintains that mental abilities are not general capacities that can be developed indifferently to subject matter, as Descartes believed, but are skills formed in the progressive differentiation of the mind. Effective thought in mathematics has little to do with aesthetic awareness or moral sense. Consequently for Hirst, an intellectually developed person is one who has acquired the skills of inquiry and the command of concepts in all the important domains of thought.

When the social nexus of reason is examined, Hirst (1974) claims that seven distinct autonomous and non-reducible modes of experience come into focus. These "forms of knowledge" may be distinguished by three criteria: the procedures of inquiry they adopt, their unique tests for truth, and the characteristic network--or logical grammar--of categorical concepts that each area generates. While such divisions may suggest transcendental components of mind, Hirst (1974) is adamant that the categories of thought do not arise from an innately structured intellect, but develop--through history--out of linguistically based conceptual schemes rooted in socially defined forms of life. Accordingly, Hirst continues, through the emerging traditions of mathematics, science, aesthetics, morality, religion, interpersonal knowledge, and philosophy Western culture has shaped and continues to structure experience. Thus, while not dismissing the possibility that other equally legitimate forms of inquiry may develop in response to the demands of future life, Hirst (1974) complements the epistemological component of his thesis with the pedagogical argument that education is the development of the mind through the initiation of the subject into these distinct ways of experiencing the world.

> Mental development is seen as centrally involving initiation into a world of public objects which itself is in a significant sense a public creation. It is the achievement of shared traditions of thought, that is, shared ways of discriminating and classifying, and shared ways of bringing such categories into relationship and testing for their validity. It is thus the public rule structures--the standards--articulated and embedded in such traditions which constitute mind in a very fundamental sense. Only through the acquisition of such standards can man enter a world of human significance. And only by reference to such standards can he in turn contribute to it, for being critical and creative involves more than mere contrasuggestibility and self-expression. (p. 515)

Moreover, by defining mind in terms of knowledge, Hirst maintains that his thesis, like the classic Greek ideal of a liberal education, requires no external justification. Just as the original concept was grounded in the desire to free reason from error by escaping the contingent demands of society, so for Hirst an education based solely on the pursuit of knowledge provides the ultimate basis for the rational life. Yet Hirst does not advocate teaching the seven forms in the way the Greeks emphasized the seven liberal arts; the divisions in knowledge he identifies are not the boundaries of school subjects. As Hirst recognizes, social and psychological factors often override epistemological distinctions in the organization of the curriculum. For example, learning is often centered around culturally important disciplines like geography, which incorporates several forms of knowledge. Again, as Piaget (1970) argues, children can come to appreciate the a priori truths of mathematics only after reflecting on their empirical knowledge of the world.

Hirst's point is that the development of mind is a process in which the child gradually learns to approach and disseminate experience in these seven unique ways. Although the world is not neatly packaged in these distinct logical areas, Hirst believes that thought can proceed only by abstracting ideas from the continuous flux of experience in order to direct analysis in these different avenues of inquiry. The teacher's task is thus one of demonstrating how these historical traditions can be applied and articulated. In short, Hirst's forms of knowledge are the socially produced tools through which we craft our understanding of the world, and education, like an apprenticeship, is the child's gradual initiation into their proper employment.

Taken together, the writings of Hirst and Peters (1971) advocate an education free from the demands of specialization and vocational training. Based upon the abstract ideal of an educated person, their synthesis suggests that children can share in the historical achievements of knowledge and value that underwrite the life of reason. As Dearden (1984) recalls, this fusion of knowledge and mind, although theoretical in its inception, was nonetheless extremely influential in orienting practical inquiries into the aims, methods, and content of education. "Not only fellow philosophers of education but also members of the Inspectorate, writers of Schools council working papers as well as students and teachers became aware of the 'forms of knowledge' and pondered their implications for curriculum and method." (p.23)

Although Hirst and Peters (1971) reject the education as growth model, the theory of development they endorse still falls short of the arguments I presented in favor of the constructive mind thesis. This can be seen most clearly in Hirst's theory, where the implicit biologism of the structured mind view is replaced by an equally unfounded epistemological essentialism. So while recognizing the historical construction of concepts, Hirst attempts to define mind independently of society through a pure analysis of knowledge. His aim, once again, is to fulfill the classic quest of defining education as the pursuit of knowledge for its own sake. Yet, unlike the Greeks, whose arguments rest on a very different set of metaphysical beliefs about the nature of mind and reality, Hirst cannot assume that the acquisition of knowledge is the highest form of good. For instance, one can imagine that a curriculum based upon the notion of learning for its own sake could lead students to value "petty" intellectual games that have little relevance for the practical concerns of life.

Contemporary critics were quick to recognize the essential weaknesses in Hirst's and Peters's attempts to provide an intrinsic justification of education (Dearden, 1986). Influenced by Michael Young's (1973) Marxist analysis of schooling as an instrument of social control operating through the privileged accessibility that certain classes have to knowledge, many viewed Hirst's thesis as an attempt to legitimize the educational status quo. Although some philosophers saw the "sociology of knowledge" thesis as more of an irritation than a serious philosophical challenge (Peters, 1983), it nonetheless served to remind educationalists that human interests are socially grounded. Indeed, in Ambiguities in Liberal Education (1977), Peters demonstrates the limitations implicit in his earliest conviction that knowledge should be pursued for its own sake. In particular, he challenges the assumption that pure inquiry is superior to practical studies by comparing the abstract musings of an academic with vocations like medicine and engineering that may enrich the lives of many. Moreover, echoing Dewey (1916), Peters also maintains that even technical activities such as woodwork and daily tasks like cooking may be just as rewarding as intellectual pursuits. In fact, it can be argued with some persuasion that such practices are superior, for in addition to the enjoyment and cognitive challenge they offer the learner, these pursuits are also of service to others.

For many, including Peters (1974), Hirst's (1974) epistemological claims also are too bold. For instance, his argument that the development of mind is achieved by initiating the subject into the seven distinct forms of knowledge surely is much too strong, since there are, for example, educated scientists and literary figures who have little knowledge or skills within each other's areas. In contrast to Hirst, Peters's (1966) holds the more reasonable position that intellectual growth is marked by the acquisition of cognitive perspective--the ability to consider all sides of an issue--rather than the differentiation of thought into autonomous domains. Further, Hirst's efforts to chart the internal boundaries of knowledge through the logical grammar of concepts has generated a skeptical response from philosophers on at least three different counts.

First, it seems inappropriate for Hirst to name each domain of inquiry a "form of knowledge." Quite clearly, areas like aesthetics and religion pertain more to the evaluation of beliefs than to questions of truth and may therefore be accurately described as modes of experience. Second, even if it is accepted that his three criteria do partition knowledge into distinct ways of approaching experience, Hirst provides no explanation for why his list of seven forms should be considered exhaustive. Indeed, the principles he stipulates can be applied consistently to activities as different from philosophy and history as bingo and chess. Third, the divisions that Hirst identifies mask the network of underlying relationships that permeate the entire spectrum of knowledge. Thus physics cannot be separated from mathematics any more than religion can be discussed independently of morality. This point is not simply a distinction between questions of logic and questions of practice, since for anyone committed to the truth of Quine's (1960) analytic/synthetic argument, all knowledge must be seen as part of a single homogeneous body of concepts.

In all, while Hirst no doubt has invented a useful template for highlighting differences among areas of knowledge, his forms are not "natural kinds" and cannot reveal the myriad relationships of continuity and difference that exist within the whole range of human efforts to construct meaning from experience. As Dearden (1984) summarizes,

> the very notion of a "form" has been declared unclear. The list of forms has been challenged in its completeness and indeed its correctness. Is religion really a form of knowledge? Does history have distinctive concepts? Is not geometry a very different 'form' from algebra? the conception of a distinctive truth-test has been argued to be much too simple and the analytic strategy has been seen as scientistic. The exhaustiveness of the division has been challenged on the grounds that much commonsense knowledge appears to fall into none of the forms, so that it must be a set of specialized disciplines which are being described. In that case, the forms will not be the conditions of any possible experience or of all mental development. . .and what of justification? Why attach importance to an initiation into forms of knowledge? surely their importance cannot lie just in their formal distinctiveness? And can they really be regarded as being of equal weight? (p. 33)

It is not possible to determine principles of curriculum design from the fact that differences exist between areas of knowledge. As I have argued, Hirst's criteria permit the identification of numerous trivial activities that would be quite out of place in schools. Nor can intellectual pursuits be justified through Peters's (1966) transcendental argument--Hirst's (1974) second gambit--since the point of such inquiries may not rest in their intrinsic nature but rather on the ends to which they can be put.

In brief, any attempt to define the development of mind through conceptual analysis is doomed to failure precisely because the value of intellectual pursuits are inextricably tied to the cultural context of life. The notion of a liberal education put forth by Hirst and Peters (1971) represents only one view about the purpose of this enterprise. Its influence and popular appeal derive from the attempt to insulate the subject from the demands of society by showing--in the equation of mind with knowledge--that education is tied to the development of the individual rather than the dictates of the state.

Yet as the criticisms I have presented demonstrate, education can encompass many other equally legitimate ends, including service to the community. The point is not to engage in a search for the essential meaning of the term--as if epistemology can provide an ultimate foundation for human pursuits--but to recognize the competing claims in relation to the forms of social organization in which they are grounded. Thus, rather than attempting an intrinsic justification of education, Peters (1981) came to offer a defense of the form of life that supports the pursuit of knowledge for its own sake.

Education, Society, and Mind

Education and the Democratic Life

The arguments in the previous two sections demonstrate that the concept of education cannot be abstracted from the social context of life. The education as growth metaphor, based upon the psychological thesis of the structured mind, misrepresents cognitive development by comparing it to physical maturation. But human actions cannot be reduced to nature. As Peters (1974) shows, in a fundamental sense the mind of each individual is constituted by the ideas, values, knowledge, and beliefs acquired from their participation within a community. Likewise, the attempt to define education through the analysis of concepts like "mind" and "rationality" commits the opposite mistake of psychologism, epistemological essentialism. The abstract notion of an educated person formulated by Hirst and Peters (1971) is simply one view among many about the purpose of education. Indeed, as Peters (1981) later recognized, "education," like "democracy," is an essentially contestable concept that depends upon the kind of life its advocates wish to promote. Accordingly, rather than attempting an intrinsic justification of education, Peters (1981), like Dewey (1916) before him, argues for democracy as the best form of social organization. If these arguments are accepted, then the crafting of educational aims becomes the task of identifying the skills and states of mind necessary for participation within this social order.

Throughout his writings, Peters (1966) identifies democracy as

> a way of life in which high value is placed on the development of reason and principles such as freedom, truth-telling, impartiality and respect for persons, which the use of reason in social life presupposes. This development of reason would be unintelligible if value were not also accorded to the overarching ideal of truth. In spite, however, of this firm commitment to specific values in a democracy, it will be noted that they are predominantly of a procedural sort. By that I mean that they make demands on how social, political and personal life ought to be conducted. They do not provide a blueprint for an ideal society or indicate what sort of life is most worth living (p. 218).

The principal claim of the democratic life is that each person is in the best position to decide their own actions and manage their own affairs. Democratic citizens are autonomous and self-sufficient individuals who are able to support themselves within the community and make rational choices in the government of their affairs. The question facing educators thus is one of determining how schooling can promote such skills and desirable attitudes.

While this obviously raises a number of empirical and pragmatic concerns that can be addressed only through detailed interdisciplinary studies, it is possible to lay out several very general curriculum guidelines necessary to the achievement of these aims. For example, if self-sufficiency is to be a goal of education, then at a minimal level children must acquire certain basic abilities necessary to support themselves in the world. There are two sides to this requirement. First, schools should be sensitive to the economic needs of society in order to prepare and tailor students with the skills demanded by the workplace. A young person leaving school who is unable to offer a prospective employer any relevant knowledge and abilities will be incapable of securing a job and making a living wage. This condition must not be read as a mechanism for funnelling children of a certain background into specific jobs in order to retain the cultural status quo, but rather as a demand that all students leave school literate, numerate, and with the basic practical skills (perhaps even a knowledge of computers) necessary for further and more specific vocational training. Second, also at a minimal level, all students should receive instruction in some of the basic practical tasks necessary to the conduct of their daily lives. Here I have in mind matters concerning sex and drug education, health, basic economics, social and political organization, and even problems arising within the home.

If these practical and vocational aims provide a kind of least common multiple for the education of the self-sufficient citizen, then academic study--the core of the curriculum--must be directed toward the development of intellectual capacities necessary for rational decision making in an open-ended world. Just as Hirst's (1974) concept of a liberal education is tied to the development of the intellect, so the central aim of academic inquiry is to construct autonomous agents by initiating students into the various public traditions of inquiry that support the achievement of rational thought. Accordingly, while the details of Hirst's (1974) epistemological arguments may be challenged, in particular his belief in seven distinct forms of knowledge, his attack on generalized mental abilities such as "critical thought" demonstrates that the mind is developed through the various historically established ways of approaching experience. The appropriate turn in this argument is, therefore, to reject Hirst's pure, internal analysis of concepts--as a legitimate basis for curriculum design--and to follow Peters (1981) in determining what knowledge is required to face the human condition. Amending Peters's argument somewhat, I suggest that students must develop their understanding in each of the following five domains.

First, children should be introduced to the physical world through the natural sciences. Disciplines like physics, biology, and chemistry help explain the environment and bring order and predictability to experience. Moreover, in addition to the obvious technological benefits that such research yields, these inquiries also shape our view of human nature and the purpose of life. Accordingly, while vocational studies of scientific applications may be useful, the fundamental concern in the development of rational thought is to introduce students to this mode of inquiry and its central role in our current conception of the world. Integral to this endeavor is the study of mathematics. Of course, as Hirst argues, mathematics can be regarded as an independent discipline with its own distinctive concepts, tests for truth, and procedures of inquiry; and indeed it is in this abstractness from experience that its unique power resides. However, if mathematics is not to be reduced to a game-like activity, every effort must be made to demonstrate how its pure methods can be combined and applied with the practical pursuits of science.

Second, in contrast to the physical world stands the social world of human culture. Just as complex, through perhaps more confusing and less predictable than natural phenomena, human actions generate innumerable problems that must be addressed intelligently by the autonomous member of a democratic society. In order to escape dogma and bigotry, children must learn to make informed decisions based upon carefully grounded knowledge about human behavior and social norms. This can be achieved only by studying people in other times and places through disciplines like history, geography, sociology, and anthropology. The insights into human nature provided by these inquiries help relativize our own condition and provide a more objective view of the social context of life in which rational decisions must be made.

Third, in addition to these more formal approaches to culture, knowledge of other lives and values can be gained through the study of foreign languages, literature, and the fine arts. Here we enter the imaginative world in which men and women learn to express their feelings and beliefs about the purpose and significance of life.

By detaching children from their current situation, the aesthetic domain can focus on the thoughts and emotions of others. It is by exploring these various responses to experience that students can come not only to respect the dignity of others but also to shape and control their own feelings. To this end I believe that literature in particular can lead children beyond social and national mentalities to understand the life condition and the thoughts of others, an essential requirement in today's globally interactive world.

Fourth, to prepare students to face the ultimate questions of life and death, the curriculum also must include some introduction to the world of religious beliefs. While this may or may not demand the establishment of a distinct school subject, it seems important that this area should be related to each of the other domains in order to understand the orienting role that faith plays in uniting the physical, social, and imaginative aspects of experience.

Fifth and finally, if society is based upon the democratic principle of self-government, then each citizen must be responsible for his or her own moral conduct. While forming moral judgments may not be the pure intellectual task pictured by Kant (1787/1964), insofar as it involves the weighing and assessment of knowledge it clearly incorporates a cognitive component. Education can guide children in such decisions by demonstrating how to examine and compare various sides of a situation. Further, extending my remarks about the imaginative world, an introduction to human nature through literature and the arts seems to hold the most promise of developing in children qualities like compassion, empathy, and a sense of justice.

My objective in presenting these brief comments on the structure of the curriculum is to indicate, in broad terms, the range of abilities necessary for participation in the democratic life. However embryonic these thoughts may be, they nonetheless demonstrate the kinds of judgments and considerations to be given when the aims of education are dictated by each person's right to self management. Central to this argument is the claim that education must be both practical and theoretical. At a minimal level, students must learn to support themselves in the world with the skills necessary for both daily life and employment. Conversely, through academic study in the areas of knowledge I have described as being pertinent to the human condition, each person can learn to face experience in a rational and informed manner.

Not only is this the best arrangement for the individual--allowing everyone the freedom to pursue their own interests in a responsible manner--but it also proves to be the best form of social organization, maximizing the number of informed and intelligent citizens who can contribute to the rational development of the culture. As Peters (1966) argues, the concept of democracy rules out any blueprint for life and establishes society as a collaborative body of autonomous agents engaged in the historical struggle of bringing order and meaning to a problematic world. Education is the construction of the mind with the necessary skills to participate in this form of life.

Summary

Although my proceeding remarks on curriculum organization may seem remote from the more technical criticisms of structuralist thought presented in earlier chapters, I believe they indicate the kinds of educational judgments that follow once the socially constituted nature of mind is recognized. Like the education as growth metaphor and the traditional pedagogy of the passive intellect, the constructivist thesis I have supported combines complementary theories of mind and value. Both stand in opposition to the biologically based individualism of the structured mind thesis by emphasizing that human nature and conduct can be understood only in the context of the rules, conventions, and norms that define the life of a culture.

Admitting the social component of mind does not detract from the fantastic biological complexity of the brain. Clearly all normal humans are born with sophisticated learning skills and innate capacities that govern the course of intellectual development. Some, like Mozart, are gifted with spectacular potentialities that set them apart from the average person. Yet even Mozart's talents could not have emerged outside of culture--he was not born knowing how to play the piano or how to compose music--since, like other intellectual skills, his abilities were grounded in socially constituted ideas, instruments, and activities.

The chief mistake of the structured mind thesis is the assumption that human abilities can be reduced to a governing grammar of rules that somehow are programmed in the brain. I have maintained that this argument is biologically unfounded, individualistic, and theoretically underdetermined. Just because a range of behaviors can be modelled by a system of rules does not imply that such structures are psychologically real. Indeed, as Searle (1980) argues, syntax is not an intrinsic property of any natural object, but rather a set of relationships that are read into objects satisfying certain formal requirements. Thus, although Stonehenge can be considered a computational mechanism by virtue of the law-like regularities it exhibits, it is important to recognize that such rules are not produced by the rocks that compose the structure but by the interpretation human beings impose upon them.

This same conclusion follows for the many properties of the brain. The fact that the human mind appears to manipulate abstract symbols in a logical manner does not mean that the brain is a computer. Hamyln (1981) makes a similar point when he recognizes that the research programs followed by cognitive scientists are determined by the vocabulary of folk psychology. Terms like imagination, attention, memory, perception, and consciousness are socially defined categories and not necessarily natural kinds at the neurophysiological level. Cogitivists, as Hamlyn (1981) observes, have failed to appreciate this point in their efforts to construct logical models of mental functions.

> I suspect that part of the reason for concentration on restricted sub-systems, as seems to be characteristic in cognitive psychology, lies in the hope that this will provide connections with brain research. If I am right, that may in the end prove an illusion. Not that cognitive functions do not have a basis in the brain, but that the individual's brain is not their only basis. That must be so if reference to others is required at some point if a full understanding of any one individual's cognitive processes is to be attained. In consequence a premature appeal to brain functioning may be more obfuscating than illuminating. (p. 118)

Even Piaget's efforts to explain the development of mind through a generalized self-organizing logic of adaptation fails to do full justice to the socially grounded character of thought. For while Piaget does recognize the social component in development, the systems-oriented arguments of his later writings suggest that changes in structure are generated by internal mechanisms of compensation. I have argued that Piaget's attempt to forge a logic of progress in the biological, psychological, and epistemological domains is unconvincing, ultimately expressing what appears to be a 19th century metaphysical belief in the inner purpose of life. There is no equilibrium principle controlling the development of ideas through history, just as there is no internal vector at work in the evolution of species. As Popper (1979) and Foucault (1966) show, the growth of scientific knowledge rests upon a series of irrational conjectures or mutations, advances that cannot be captured by an abstract system of rules.

If knowledge does indeed become more objective--or better adapted to experience--then such advances must be explained through post hoc techniques of selection. Just as the Darwinian thesis establishes a survival of the fittest principle, so Popper (1979) argues that scientific hypotheses must be evaluated by a parallel process in which theories that reduce our ignorance of the world are promoted.

My central point is thus to deny the existence of unconscious or abstract systems of computational rules underlying and controlling thought. As the history of ideas and the psychogenesis of concepts demonstrate, reason is not guided by an internal logic of development--whether innate or constructed--but depends upon socially agreed values and conventions. The syntactic models of thought processes presented first by structuralists and then by cogitivists fail to capture the most pervasive feature of the mind, the fact that human actions can and must be understood in terms of reasons. Of course the brain, like any other material object can be investigated for its causal properties, but as I have suggested, such inquiries may prove less than illuminating on two counts. First, since there is no level of deep structure between consciousness and brain states, explanations of behavior in terms of neuron firings inevitably will be quite unrevealing, especially to the teacher. Second, since reason is an emergent property of both nature and culture, the social component of thought ultimately will frustrate all attempts to frame a science of the mind. Like the physical world, the regularities in human nature may be based upon a causally inexplicable foundation.

If the structural explanations of Lévi-Strauss, Chomsky, and Piaget are rejected, then folk psychology remains the most convenient and accurate way of understanding human behavior. Accordingly, rather than trying to determine how thought rests on underlying grammars, educationalists must recognize the truth of Peters's (1966) conviction that, in a fundamental sense, the mind is actually constituted by the ideas, values, and knowledge acquired in the course of experience.

Recognizing the limits of psychological explanation, Peters (1973) attempts to direct educational inquiry away from the theoretically generated concerns of the subject specialist and toward the concrete problems of the teacher. His aim is not to deny that scientific studies of human nature are either possible or valuable, but rather to curb the desire among researchers to emulate the rigor of the natural sciences. To this end, Peters (1977) promotes a series of interdisciplinary projects in which psychologists, sociologists, and philosophers of education conduct piecemeal inquiries into the important issues of schooling. By cooperating in this manner, disciplinary research can be integrated into a modest but relevant corpus of knowledge that actually can inform the teacher. Moreover, in forging this link between theory and practice, Peters (1977) adds to the academic standing of educational studies while indicating how teaching can approach the level of a profession.

In Peters's (1966) opinion, the first task of educational studies is to define the nature and purpose of the educational enterprise. Applying the techniques of conceptual analysis, Peters attempted to provide an intrinsic justification of education by showing that the development of mind is achieved by initiating children into the historically established traditions of inquiry. Under the influence of Hirst (1974), this thesis was extended to the claim that the liberally educated person is one who can differentiate experience through seven distinct forms of knowledge. Under the force of many socially grounded criticisms and his own reflections on the value of the liberal ideal, Peters rejected the implicit essentialism of these epistemological arguments in favor of the Deweyian realization that educational aims must reflect cultural values.

Like Dewey (1916), Peters (1981) defends democracy as the best form of social organization. Its procedural principles maximize interactions, foster the flow of opinions, and generally support the most rational forum for examining the problems of an uncertain and changing world. In the final section of this chapter, I have described some of the skills and qualities of mind necessary for participation in the democratic life. If children are to learn how to manage their own affairs responsibly and intelligently, schools must combine a level of practical training with the academic pursuits necessary to increase cognitive perspective on the human condition.

The mind is not an inner organ growing according to predetermined instructions, but is something to be constructed out of the knowledge, beliefs, and values an individual acquires in the course of experience. While there are no final solutions to the problems of life, by sharing in the historical achievements of human culture, children can be initiated into a rational view of the world that permits the critical appraisal of ideas and the purging of superstition and bigotry.

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BIOGRAPHICAL SKETCH

I was born an only child to Margaret and Charles Tomlinson in Harrogate Yorkshire, a small country town in northern England. Upon completion of my secondary education I enrolled at Shoreditch Teachers College where I took a four-year joint degree in mathematics and education. I then taught high school mathematics for two years before attending London University Institute of Education where I completed a master's degree in the philosophy of education. Throughout the 1980s I worked for the mathematics department at the University of Florida, coordinating and lecturing in various undergraduate classes. At the same time I earned a master's degree in philosophy and a doctorate in the foundations of education department. Upon graduation, in August 1991, I will take up a teaching position in educational studies at the University of Alabama.

I became interested in the philosophy of education, and philosophy in general, while attending Shoreditch. Like other teachers colleges within the London University system, Shoreditch recently had introduced a four-year degree in educational studies to supplement the Teaching Certificate (a three-year methods-oriented program). This degree was instituted largely through the efforts of R. S. Peters, who argued forcefully that education could become a university discipline (within the British system) if the traditional "history of ideas" approach were replaced by an interdisciplinary study that integrated current thought in psychology, sociology, history, and philosophy to tackle the concrete concerns of the teacher. These were exciting times for educationalists, for it seemed that purposeful work was being conducted, and a corpus of knowledge acquired, that could be used to prepare students with the skills relevant to their future careers. I still share this optimism in the value of Peters's approach.

My initial interests centered chiefly on questions concerning the nature and justification of knowledge. However, in contrast to the behavioristic theories of meaning put forward by Anglo-Saxon philosophers, I did not believe that epistemology can be divorced radically from psychology, and so I developed an interest in Piaget's genetic studies and Chomsky's work in linguistics. At the same time I also became skeptical about the implicit nativism and individualistic orientation of the cognitive sciences. Pursuing these and other ideas in my graduate studies, I soon found that my philosophical and educational concerns were tied to larger questions about human nature and the development of mind.

As the arguments of this dissertation illustrate, I sought a compromise between causal and rational explanations that would do justice to the role of both nature and culture in human experience. For while the brain and perceptual mechanisms contain a great deal of knowledge about the world--acquired through the process of evolution--human beings, it must be recognized, are socio-historical as well as biological creatures. Although this chaotic union frustrates all efforts to create a science of the mind (e.g., cognitivism) it supports the important conclusion that education is the construction of mind through the initiation of children into the values and knowledge and underlie the rational and self-sufficient life demanded by a democratic society. I see my current research as being directed toward exploring the pedagogical and curricula implications of this thesis.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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